

WATER
SOURCES

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WORK PLAN

FOR WATERSHED PROTECTION, FLOOD PREVENTION,
and AGRICULTURAL WATER MANAGEMENT

JORDAN CREEK WATERSHED

JAN 13 1975

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Warren County, Indiana
Vermilion County, Illinois

U. S. DEPARTMENT OF AGRICULTURE
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ADDENDUM

to the

JORDAN CREEK WATERSHED WORK PLAN

Warren County, Indiana
Vermilion County, Illinois

This addendum is in response to the established Principles and Standards of the Water Resources Council and has been developed in accordance with the USDA Procedures for Planning Water and Related Land Resources.

Information included consists of:

- I. Evaluation of Plan With Current Installation Costs and Discount Rate
- II. Abbreviated Environmental Quality Plan
- III. Selected Plan - Display Tables

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JORDAN CREEK WATERSHED

I. EVALUATION OF PLAN WITH CURRENT INSTALLATION COST AND DISCOUNT RATE

This addendum shows project cost based on 1974 price base for installation costs amortized for 100 years at 5 7/8 percent interest.

Benefits for this addendum are based on current normalized prices for agricultural commodities.

Annual project benefits, costs and benefits--cost ratio are as follows:

Total Benefits	\$508,757
Total costs	123,620
Benefit-cost ratio	4.1:1.0

JORDAN CREEK WATERSHED

II. ABBREVIATED ENVIRONMENTAL QUALITY PLAN

ENVIRONMENTAL PROBLEMS

Areas of natural beauty

The watershed has a limited variety of scenery because of land use patterns, topography, lack of lakes, perennial streams, major water courses and other natural features. About 92 percent of the area is devoted to agricultural uses with 8 percent in wildlife, recreation, and forest land.

The lower reaches of Jordan Creek are fairly well entrenched, wooded, and have some rock riffles. This area is small and is included in the previously mentioned 8 percent.

Water and land quality

Erosion in terms of sediment production is slightly above tolerable limits on 21,700 acres of cropland or 20 percent of the watershed. The average sediment loss on this area is estimated at 3.9 tons/acre/year. which is above the tolerable limit of 3.5.

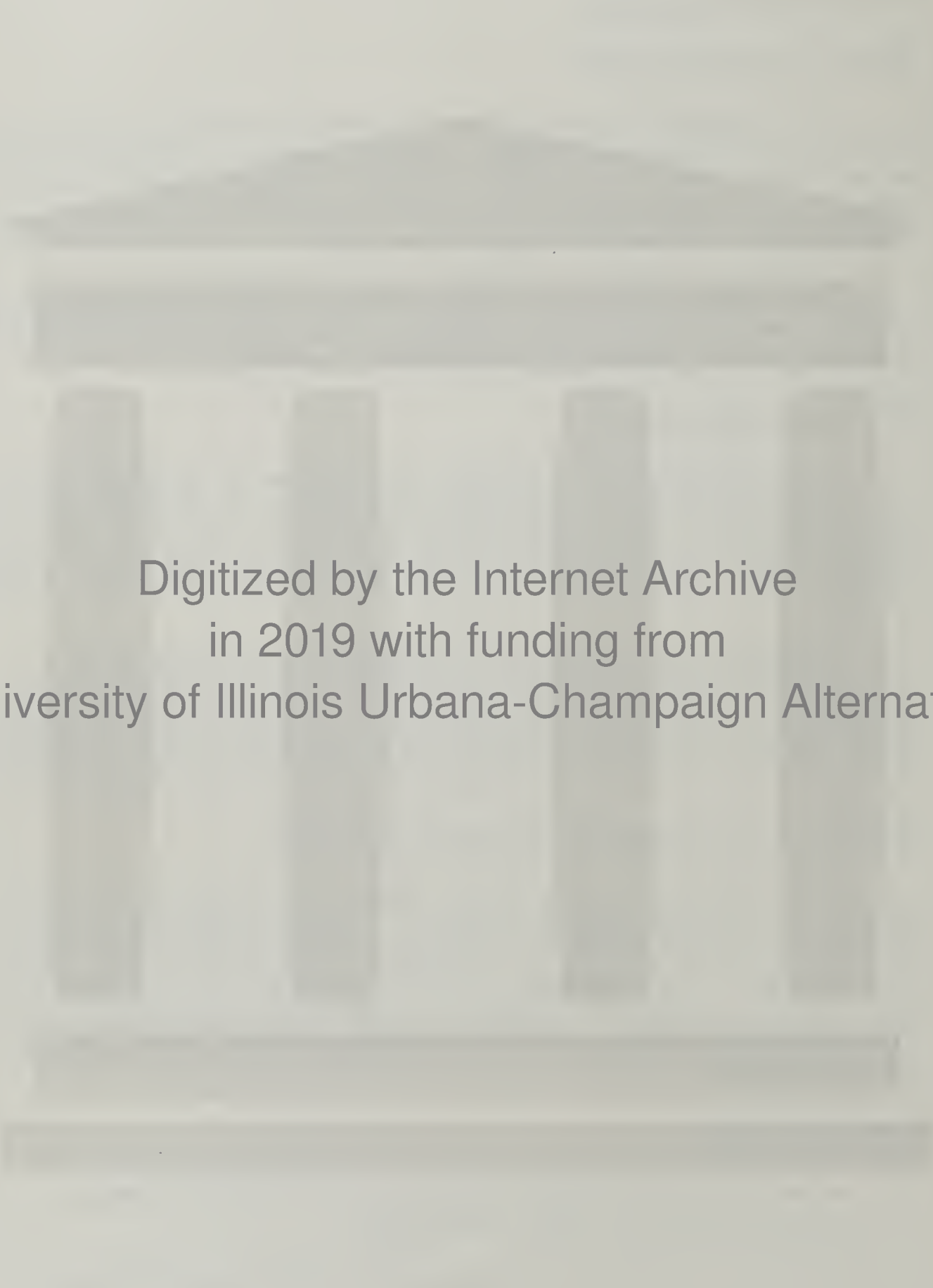
Sediment yield from the watershed is low: about 0.33 tons/acre/year for Indiana and about 0.21 tons/acre/year for the Illinois portion of the watershed. However, high intensity, short duration storms on fallow field conditions will periodically discharge sediment and associated pollutants into Jordan Creek.

Biological resources and selected ecosystems

The predominant agricultural monoculture provides a small amount of unvaried wildlife habitat. Clean-tillage practices destroy suitable habitat for wildlife species that favor upland agriculture. The watershed is short of surface water habitat for fish and wildlife. However, Jordan Creek downstream of the Illinois-Indiana state line has suitable habitat for a mature sport fishery.

COMPONENT NEEDS

1. Improve water and land quality by controlling erosion, sedimentation and other pollutants.
2. Establish, improve, and manage fish and wildlife habitat.
3. Provide diversity of landscape.



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JORDAN CREEK WATERSHED

PLAN ELEMENTS

1. Install appropriate land treatment measures on about 35,567 acres.
Included are contour farming, grassed waterways or outlets, minimum tillage, crop residue use, grade stabilization structures and other measures as needed. Soil conserving mechanical practices and cropping systems would be applied on all croplands. Pasture would be used and managed to protect stand cover and maintain vigor of desired plant species. The estimated cost of installation including technical assistance is \$913,690.
2. Implement proper land use within capability. Convert 21,700 acres of cropland presently exceeding tolerable soil loss to pasture or forest land. The estimated installation cost including technical assistance is \$1,827,350.
3. Eliminate feedlot discharge into streams and ground water aquifers. Install 55 holding ponds for livestock feedlot runoff at a cost of \$189,750.
4. Convert about 5,600 acres of cropland into parcels of forest land. These parcels should be 10 acres or larger and should be scattered throughout the watershed on soils suited for trees involved. The estimated installation cost of this conversion, including technical assistance, is \$9,044,000.
5. Establish about 2,600 acres of upland wildlife areas in scattered blocks such as in "off field" areas and along fence rows and ditchbanks. The vegetation should be a mixture of trees, shrubs and herbaceous plants which have a high value for wildlife food and/or cover. The estimated establishment cost, including technical assistance, is \$4,129,000.
6. Convert about 2,500 acres of cropland to wetland. A large, single block of wetland is more desirable than scattered wetland areas. The estimated cost of conversion, including technical assistance, is \$2,802,125.
7. Restrict land use for a distance of 50 feet from each edge of the stream or ditch banks. The acreage involved could be considered as part of the 2,600 acres of the upland wildlife area previously mentioned. The estimated installation cost, including technical assistance, is \$158,563.

JORDAN CREEK WATERSHED

PLAN ELEMENTS CONT'D

8. Install stream improvements for fish and wildlife habitat downstream of the Illinois-Indiana state line on Jordan Creek (approximately 7 miles). Appropriate measures would be: livestock exclusion, bank stabilization, fish cover provisions such as overhangs and clean-up of litter. The estimated installation cost, including technical assistance, is \$139,000.

INSTITUTIONAL ARRANGEMENT

Institutional arrangements available and needed for the implementation of the Environmental Quality Plan. Legal entities of government are in existence for the implementation of the EQ Plan. They include township and county government, joint powers of county government and soil and water conservation districts. Township and county governments have the power of eminent domain and taxation by law.

State and federal programs are available providing financial assistance both for land acquisition and for establishment of measures to implement the EQ Plan, namely:

State Programs

Indiana Department of Natural Resources and Illinois
Department of Conservation

- a. Forestation Program - Provide tree planting stocks and technical assistance.
- b. Private Land Wildlife Habitat Improvement Program - Provide technical assistance to create wildlife habitat on private lands.
- c. Natural Resource Funds - Provide financial assistance for developing fish and wildlife habitat.

Federal Programs

1. U.S. Department of Agriculture

- a. Resource Conservation and Development - Financial and technical assistance involving human and natural resources

JORDAN CREEK WATERSHED

INSTITUTIONAL ARRANGEMENT CONT'D

- b. Rural Environmental Conservation Program - Provides cost sharing assistance to individual landowners for application of conservation practices.
 - c. Loans and Advances - Provide loans and advances to sponsoring organizations.
2. U.S. Department of Interior
- a. Pitman-Robertson Funds - Provides for wildlife research and financial and technical assistance in developing wildlife habitat areas. Administered by the state.
 - b. Dingell-Johnson Funds - Provides for fishery research and financial and technical assistance in developing fishery habitat areas. Administered by the state.

Technical assistance including educational and on-site assistance is available from:

1. Warren, Indiana and Vermilion, Illinois Soil and Water Conservation Districts
2. Cooperative Extension Service
3. Indiana Department of Natural Resources
4. USDA including Soil Conservation Service and Forest Service
5. USDI, U.S. Fish and Wildlife Service
6. Illinois Department of Conservation

EFFECTS

Water and land quality

The installation of the land treatment measures will reduce the average annual soil loss on 21,700 acres of cropland from 3.9 tons/acre/year to the tolerable limit of 3.5 tons/acre/year. The measures will reduce erosion and sedimentation by 25 percent and decrease the watershed's contribution of sediment to Jordan Creek from 12,000 tons/year to 9,000 tons/year. This reduction will reduce agricultural pollutants that are borne by sediment.

JORDAN CREEK WATERSHED

EFFECTS CONT'D

Implementation of land use compatible with the soils capability can reduce erosion and sedimentation in the same manner as land treatment. Therefore, the effects on water and land quality would be similar.

Biological resources and selected ecosystems

The installation of the forest land, upland wildlife habitat, wetlands, the 50-foot strip each side of the stream, and the 1.5 miles of stream improvement will increase desirable habitat for fish and wildlife considerably over the existing conditions.

The nature of the habitat (upland, wetland, forest land) will be compatible with many species of plants and animals that are now scarce or nonexistent in the watershed.

The amount of land required for land use conversion, for improved environmental stability, and for wildlife habitat purposes is approximately 10,700 acres or about 14 percent of the watershed area.

The population of bobwhite quail and other game species such as cottontail rabbit, ringneck pheasant, and squirrel would be improved by an estimated 400 percent. Non-game wildlife species such as songbirds and small mammals would be increased by an estimated 500 percent.

JORDAN CREEK WATERSHED

SYSTEM OF ACCOUNTS DISPLAY

The following tables illustrate a display of beneficial and adverse effects of the selected plan for Jordan Creek Watershed in the National Economic Development, Regional Development, Social Well-Being and Environmental Quality Accounts.

JORDAN CREEK WATERSHED

III. SELECTED PLAN - NATIONAL ECONOMIC DEVELOPMENT ACCOUNT: The following table reflects increases in the Nation's productive output.

Dollars

<u>Components</u>		<u>Measures of Effects</u> Average Annual	<u>Components</u>	<u>Measures of Effects</u> Average Annual
Beneficial Effects			Adverse Effects	
A. The value to users of increased outputs of goods and services.	1. Flood prevention		A. The value of resources required for a plan.	
	2. Drainage			
		\$154,135		
		141,672		
			1. Channel modification, surface drains, grassed waterways and tile	
			Project installation <u>1/</u>	\$91,460
			Project administration <u>1/</u>	15,630
			OM&R	16,530
TOTAL BENEFICIAL EFFECTS		\$295,807	TOTAL ADVERSE EFFECTS	\$123,620
			NET BENEFICIAL EFFECTS	\$172,187

1/ Amortized at 5 7/8 percent interest for 100 years.

JORDAN CREEK WATERSHED

III. SELECTED PLAN - REGIONAL DEVELOPMENT ACCOUNT: The following table reflects increases in the region's productive output.

Dollars

Components	Measures of Effects		Components	Measures of Effects	
	Average Annual	Rest of		Average Annual	Rest of
	Ind. & Ill.	Nation		Ind. & Ill.	Nation
Income					
Beneficial Effects					
A. The value of increased output of goods and services to users residing in the region.			A. The value of resources contributed from within the region to achieve the outputs.		
1. Flood prevention	\$154,135	--	1. Channel modification, surface drains, grassed waterways and tile	\$35,305	\$56,155
2. Drainage	141,672	--	Project installation <u>1/</u>	2,040	13,590
3. Secondary		\$-212,950	Project administration <u>1/</u>	16,530	
			OM&R	53,875	69,745
TOTAL BENEFICIAL EFFECTS	\$508,757	\$-212,950	TOTAL ADVERSE EFFECTS		
			NET BENEFICIAL EFFECTS	\$454,882	\$-282,695

1/ Amortized at 5 7/8 percent interest for 100 years.

JORDAN CREEK WATERSHED

III. SELECTED PLAN - REGIONAL DEVELOPMENT ACCOUNT

<u>COMPONENTS</u>	<u>MEASURES OF EFFECTS</u>	<u>REST OF NATION</u>
B. Employment	<ol style="list-style-type: none">1. During the period of construction approximately thirty-nine man-years of labor will be required for the installation.2. During the life of the project, about eight man-years will be required annually for the operations and maintenance for structural and associated land treatment measures.	--
C. Regional Economic Base & Stability	The average net income increase will be approximately \$3,280 annually.	--

JORDAN CREEK WATERSHED

III. SELECTED PLAN - SOCIAL WELL-BEING ACCOUNT: The following table reflects effects on society.

COMPONENTS:

A. Income distribution

1. It is estimated the income distribution of the beneficiaries of the project is 34% less than \$5,000, 15% \$5,000 to \$10,000 and 51% over \$10,000. Regional cost of \$53,875 will be shared in about the same proportion as the benefits accrued.

JORDAN CREEK WATERSHED

III. SELECTED PLAN - ENVIRONMENTAL QUALITY ACCOUNT: The following table reflects effects on the natural physical-biological system.

COMPONENTS

Beneficial and Adverse Effects:

A. Areas of natural beauty

1. Destroy 23 acres of woody wildlife habitat during construction.
2. Plant 27 acres of trees and shrubs.
3. Protect existing woody material within the permanent easement.
4. Establish a maintenance program for channels and stream banks.
5. Management of 20 acres of forest land.

B. Quality considerations of water, land and air resources

1. Increase noise, air and water pollution for a short term during construction.
2. Reduce erosion on 21,700 acres of cropland, grassland and forest land.

C. Biological resources and selected ecosystems

1. Destroy 23 acres of woody wildlife habitat during construction.
2. Plant 27 acres of trees and shrubs.
3. Protect existing woody material within the permanent easement.
4. Plant 50 acres of stream bank to grass.
5. Management of 20 acres of forest land.

D. Irreversible and Irretrievable

1. Sixty-nine acres of cropland converted to wildlife habitat. Land usage within the project permanent easement area before and after project follows:

JORDAN CREEK WATERSHED

D. Irreversible and Irretrievable - cont'd

<u>Land Use</u>	<u>Present</u>	<u>Future</u>
Cropland	69	--
Forest Land	48	52
Grassland ^{1/}	43	73
Other Land	34	69

These conversions are considered to be committed for the project life.

1/ Other land includes channel bottom and side slopes and areas providing wildlife habitat adjacent to the channel.

DRAFT

WATERSHED WORK PLAN

JORDAN CREEK WATERSHED

Warren County, Indiana

and

Vermilion County, Illinois

Prepared Under the Authority of the Watershed
Protection and Flood Prevention Act (Public Law
566, 83d Congress, 68 Stat. 666), as Amended

Prepared by:

Warren County Soil and Water Conservation District
Jordan Creek Conservancy District
State of Indiana

and the

Vermilion County Soil and Water Conservation District
Pleasant Hill Drainage District
State of Illinois

Technical Assistance By:

U. S. Department of Agriculture, Soil Conservation Service
U. S. Department of Agriculture, Forest Service
U. S. Department of Interior, Fish and Wildlife Service
Indiana Department of Natural Resources

December 1974

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WATERSHED WORK PLAN AGREEMENT

between the

Warren County Soil and Water Conservation District

and the

Jordan Creek Conservancy District

of the

State of Indiana

the

Vermilion County Soil and Water Conservation District

and the

Pleasant Hill Drainage District

of the

State of Illinois

(hereinafter referred to as the Sponsoring Local Organization)

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Jordan Creek Watershed, states of Indiana and Illinois, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Jordan

Creek Watershed, states of Indiana and Illinois, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing consideration, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about eight (8) years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organization will acquire, with other than PL-566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated Cost \$283,280). The percentages of this cost to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Jordan Creek Conservancy District</u> (percent)	<u>Pleasant Hill Drainage District</u> (percent)	<u>Service</u> (percent)	<u>Estimated Land Rights Cost</u> (dollars)
All Structural Measures in Indiana	100.0	0	0	267,000
All Structural Measures in Illinois	0	100.0	0	16,280

2. The Sponsoring Local Organization assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsoring Local Organization and the Service as follows:

	Jordan Creek Conservancy District (percent)	Pleasant Hill Drainage District (percent)	Service (percent)	Estimated Relocation Payment Costs (dollars) ^{1/}
Relocation Payments	49.0	7.0	44.0	0

^{1/} Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

3. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.
4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	Jordan Creek Conservancy District (percent)	Pleasant Hill Drainage District (percent)	Service (percent)	Estimated Construction Cost (dollars)
Multiple Purpose Channels, Surface Drains, and Water- ways in Indiana	25.0	-	75.0	992,100
Single Purpose Tile Installa- tion in Indiana	50.0	-	50.0	109,700
Multiple Purpose Channels, Surface Drains, and Water- ways in Illinois	-	25.0	75.0	51,000

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Engineering Costs</u> (dollars)
All Measures in Indiana	0	100.0	110,480
All Measures in Illinois	0	100.0	5,100

6. The Sponsoring Local Organization and the Service will each bear the costs of project administration which it incurs. The estimated costs follow:

<u>Improvement</u>	<u>Jordan Creek Conservancy District</u>	<u>Pleasant Hill Drainage District</u>	<u>Service</u>
All Measures in Indiana	33,050	-	220,360
All Measures in Illinois	-	1,530	10,200

7. The Warren County and Vermilion County Soil and Water Conservation Districts will obtain agreements from owners of not less than 50 percent of the land above each structural measure that they will carry out conservation plans on their land.
8. The Warren County and Vermilion County Soil and Water Conservation Districts will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.
9. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
10. The Jordan Creek Conservancy District and the Pleasant Hill Drainage District will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the availability of appropriations for this purpose.

A separate agreement will be entered into between the Service and the Jordan Creek Conservancy District or the Pleasant Hill Drainage District before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons of the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.
14. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

WARREN COUNTY SOIL AND WATER CONSERVATION
DISTRICT

By_____

Title_____

Address_____

Zip Code

Date_____

The signing of this agreement was authorized by a resolution of the governing body of the Warren County Soil and Water Conservation District, adopted at a meeting held on_____

(Secretary, Warren County Soil and Water
Conservation District)

Date_____

JORDAN CREEK CONSERVANCY DISTRICT

By_____

Title_____

Address_____

Zip Code

Date_____

The signing of this agreement was authorized by a resolution of the governing body of the Jordan Creek Conservancy District, adopted at a meeting held on_____

(Secretary, Jordan Creek Conservancy
District)

Date_____

VERMILION COUNTY SOIL AND WATER
CONSERVATION DISTRICT

By _____

Title _____

Address _____

Zip Code

Date _____

The signing of this agreement was authorized by a resolution of the governing body of the Vermilion County Soil and Water Conservation District, adopted at a meeting held on _____

(Secretary, Vermilion County Soil and
Water Conservation District)

Date _____

PLEASANT HILL DRAINAGE DISTRICT

By _____

Title _____

Address _____

Zip Code

Date _____

The signing of this agreement was authorized by a resolution of the governing body of the Pleasant Hill Drainage District, adopted at a meeting held on _____

(Secretary, Pleasant Hill Drainage
District)

Date _____

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

State Conservationist

Date

SUMMARY OF PLAN

The Jordan Creek Watershed includes approximately 119.3 square miles (76,352 acres) in Warren County, Indiana and Vermilion County, Illinois. Approximately 46 percent or 54.88 square miles lies in Indiana and 54 percent or 64.42 square miles of this drainage area lies in Illinois. The drainage originates in Warren County, and flows generally west and southwest into Vermilion County. Jordan Creek joins the North Fork of the Vermilion River about five miles south of Rossville, Illinois.

The project is sponsored by the Warren and Vermilion County Soil and Water Conservation Districts (SWCD's) the Jordan Creek Conservancy District (J,C,C,D) in Indiana; and the Pleasant Hill Drainage District (PHDD) in Illinois.

Major watershed problems described in the plan are: inadequate land and water management, floodwater damage, erosion and inadequate drainage.

Land treatment measures will be installed by individual land-owners and operators. Technical assistance will be provided by the Soil Conservation Service (SCS) and the Indiana Department of Natural Resources (IDNR), Division of Forestry or the Illinois Department of Conservation Division of Forestry in cooperation with the U.S. Forestry Service.

Land treatment practices considered appropriate for installation in the watershed are: conservation cropping system, contour farming, terraces, diversions, grassed waterways or outlet minimum tillage, crop residue use, grade stabilization structures, subsurface drains, drainage mains or laterals, pasture and hayland planting and management, ponds, tree planting, and forestland management. These measures include the needed conservation practices required for watershed protection.

The proposed land treatment measures will bring an additional 35,567 acres under adequate treatment. The annual soil loss from 21,700 acres of cropland with an erosion problem will be reduced from 3.9 tons per acre to 2.5 tons per acre. The amount of sediment leaving the watershed will be reduced 63 percent from the present rate of 21,000 tons per year.

The Other cost (all funds other than Public Law 566) of the land treatment measures is estimated at \$895,050 which includes \$700 for forest land measures. Public Law 566 (PL-566) cost of \$18,640 is estimated for technical assistance for the land treatment measures.

Structural measures will consist of approximately 12.2 miles of multiple purpose flood prevention and drainage channel work. This work will be enlargement, deepening and minor realignment. All work will be performed on manmade or modified channels of which 1.9 miles is considered as having perennial flow and the balance intermittent or ephemeral.

SUMMARY OF PLAN - CONT'D

Other structural measures consist of approximately 15.3 miles of new or reconstructed open ditches, 48.6 miles of surface drains, 5.1 miles of grassed waterway construction, 19.8 miles of tile in conjunction with surface drains and grassed waterways and approximately 50 grade stabilization structures to provide controlled inlets for grassed waterways and surface drains into main channel and improved open ditches. Also, about 1.5 miles of debris removal on Jordan Creek main channel is included.

Crop and pasture damages will be reduced by 40 percent, damages to roads and bridges 14 percent, and indirect damages 29 percent; approximately 16,800 acres will benefit from joint floodwater drainage relief.

The structural measures are estimated to cost \$1,816,800 of which \$1,183,270 is PL-566 cost and \$633,530 is Other cost.

The total installation cost is estimated at \$2,730,490 of which \$1,201,910 is PL-566 cost and \$1,528,580 is Other cost.

Total annual cost for installation amounts to \$107,090.^{1/} Annual operation and maintenance costs of \$16,530 will be borne by the sponsors. The total annual cost is \$123,620.

Total average annual benefits from structural measures are an estimated \$508,757 which includes flood damage reduction benefits of \$12,464, more intensive land use benefits of \$141,671, agricultural water management (drainage) benefits of \$141,672, and local secondary benefits of \$212,950.

An eight-year installation period is planned.

The ratio of average annual benefits of \$508,757 to the average annual cost of \$107,990 is 4.1 to 1.0.

^{1/} 100 years @ 5-7/8 percent interest.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical Data

Jordan Creek Watershed contains an area of approximately 76,352 acres or 119.3 square miles, and is located in northwestern Warren County, Indiana (35,123 acres) and northeastern Vermilion County, Illinois, (41,229 acres).^{1/} Relative locations of some important cities follow: Danville, Illinois, 12 miles southwest; Hoopeston, Illinois, 13 miles west; Hammond, Indiana, 75 miles north; Lafayette, Indiana, 30 miles east; and Indianapolis, Indiana, 75 miles southeast.

The watershed is not within any Standard Metropolitan Statistical Area (SMSA). The 1970 census shows Warren County, Indiana to have a population of 8,705. The county is classified as rural with the population listed as 76.4 percent rural non-farm and 23.6 percent rural farm. Vermilion County, Illinois has a population of 97,047 and except for Danville, a city of 42,570, the county is classed as rural (56.0 percent). Estimated population of the watershed is 1,564 with approximately 7 percent occupying the unincorporated villages of Tab, Stewart and Pence, Indiana.^{2/}

Present land use within the watershed with approximate acres and percent is as follows: cropland, 92 percent (70,240 acres); pasture, 3 percent (2,560 acres); forest land, 1 percent (612 acres); and other, 4 percent (2,940 acres).

A high level of agricultural production may be sustained even though a certain amount of soil is lost each year to erosion. The tolerable limit of soil loss is being exceeded on 21,700 acres of cropland scattered throughout the watershed. An additional 50,000 acres of cropland is on mineral soils having a wetness limitation for crop production.

An average of 2,117 acres is affected annually by overbank flooding. Approximately 16,800 acres have joint, inseparable flooding and drainage problems.

The climate within the watershed is typical of the region. Average annual precipitation is about 37 inches. Distribution is nearly cyclic, varying from a low monthly average of 2.26 inches in February

^{1/} All information and data, except when otherwise noted by reference to source, were collected during watershed planning activities by the Soil Conservation Service, U.S. Department of Agriculture.

^{2/} 1970 Census of Population, Advance Report, PC (VI) - 16, Indiana:
U.S. Department of Commerce, Bureau of the Census, December 1970.
1970 Census of Population, Advance Report, PC (VI) - 15, Illinois:
U.S. Department of Commerce, Bureau of the Census, January 1971.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical data - cont'd

to a high of 4.66 inches in June. Fifty percent of the precipitation falls in the growing season, often as high intensity rainfall. Snowfall varies considerably from year to year, but averages 24 inches with 4-5 inches each month from December through February.

Average daily maximum temperatures range from a low of 37° F in January to a high of 87° F in July. Average daily minimums range from a low of 23° F in January to a high of 65° F in July. Average daily temperature ranges from 29.7° F in January to 76.3° F in July. An average of 30 days per year have a maximum temperature over 90° F and the temperature falls below freezing an average of 120 days. The growing (frost-free) season averages 170 days. Average annual sunshine is 2,650 hours. There are usually 45 days a year with thunderstorms.^{1&2/}

This watershed is within National Land Resource Area (NLRA) 110, the Northern Illinois and Indiana Heavy Till Plain.^{3/} It is also within the Tipton Till Plain of Indiana, a large physiographic area covering central Indiana and characterized by nearly flat to gently rolling topography that has undergone slight modification by post-glacial streams. The altitude ranges between about 630 feet above mean sea level (MSL) near the mouth of Jordan Creek to about 830 MSL in the extreme northeastern part of the watershed, a maximum relief on the order of 200 feet. Local relief ranges from a few feet to about 50 feet, averaging somewhat less than 20 feet over much of the watershed.

The thickness of glacial drift ranges between approximately 100 and 200 feet. The surficial glacial materials consist predominantly of fine-grained glacial till in the form of ground-moraine and end-moraine deposits.^{4/}

1/ Annual Summary, Climatological Data Indiana: U.S. Department of Commerce, NOAA, EDS, Vol. 76, November 13, 1971.

2/ The National Atlas of the United States of America: U.S. Department of Interior, USGS, 1970.

3/ "Land Resource Regions and Major Land Resource Areas of the United States", Atlas of River Basins of the United States, USDA, SCS, 1970.

4/ Geologic Map of the 1°X2° Danville Quadrangle, Indiana and Illinois Showing Bedrock and Unconsolidated Deposits, Regional Geologic Map No. 2, Indiana Geological Survey, 1966.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical data - cont'd

A significant area of outwash gravel, sand and silt is mapped in the vicinity of the lower end of Middle Branch. Small, scattered areas of kame deposits (ice-contact stratified gravel, sand and silt) and lacustrine deposits of muck, peat or marl are present within the watershed. Alluvial silts, sands and gravels associated with valley-train deposits of gravel and sand are present along much of Jordan Creek.

Soils in the watershed are shown on the General Soils Map by soil association. A soil association is a landscape that has a distinctive proportional pattern of soils. It consists of two or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

The table "Estimated Soil Limitations or Suitabilities for Selected Uses" is to be used in conjunction with the General Soils Map. The table lists the percentage of each soil association, the percentage of soils in each soil association, and the limitations and suitabilities of the major soils for specific land use.

The General Soils Map, limitation table and soil association descriptions are found in exhibit 7C.

Bedrock of Pennsylvanian age crops out beneath the glacial drift. The dominant lithologies are sandstone and shale with lesser amounts of limestone, clay and coal.

There are no mineral resources being mined or produced in the watershed. Some sand and gravel is present in the outwash deposits and widely scattered stratified drift. Coal is present in the Pennsylvanian bedrock.^{1/} Neither of these resources is being commercially utilized.

Four ponds occur in the watershed. They have a total surface area of about four acres. The largest pond is approximately three acres and located in Ross Township, Illinois, Section 10 along Middle

^{1/} Cady & Gilbert, Minable Coal Reserves of Illinois, Bulletin No. 78 State Geological Survey, Urban, 1952.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical data - cont'd

Branch. All lateral ditches and the upper reaches of Main Jordan are intermittent (continuous flow through some seasons but little or none through others) and manmade or modified. The remaining streams are perennial (flows at all times except during extreme drought) and manmade or modified.

There are no known areas of wetland types 3, 4 or 5 in the watershed.^{1/} The areas that receive annual flooding and depressional ponds in the upper reaches are classified as type 1 wetlands. Crop-land comprises approximately 80 percent of these wetlands with the remainder being grassland and other land.

~~Middle Branch~~ ^{Jordan Creek} upstream from the junction of the North Fork of the Vermillion River to the junction of ~~Jordan Creek~~ ^{Middle Branch}, Reach N, consists of an entrenched channel with a narrow relatively flat valley. Near Barlow Park the channel bottom is somewhat flat, about 60 feet in width averaging $2\frac{1}{2}$ to 1 side slopes with heavy timber growth. Proceeding upstream the bottom width is 85 feet and flat with $1\frac{1}{2}$ to 1 side slopes. The flood plain contains levees perpendicular to the channel to control flood flow and scouring.

At the junction of Middle Branch and Jordan Creek the area is heavily wooded with the valley side slopes being developed for homes.

Proceeding upstream into Reach H the entrenched valley is vee-shaped with the channel bottom being relatively flat and having a width of approximately 40 feet and side slopes that are becoming more vertical due to channel meandering. The primary land use, in the lower half of Reach H, is forest land. In the upper half of the reach, to the Milwaukee-St. Paul Railroad, the valley changes to a wide flat flood plain with an entrenchment about 20 to 30 feet compared to the surrounding plain. This portion of the flood plain is being utilized as pastureland with the remaining area being forest land. The channel is 40 feet in width and has a depth of approximately eight feet. The side slopes are vertical and the channel bottom is parabolic in shape.

Reach F spans the area from the railroad to the Indiana-Illinois state line and includes Pleasant Hill Drainage District. The channel

^{1/} Wetlands of the United States: U.S. Department of the Interior, Fish and Wildlife Service, Circular 39, 1971.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical data - cont'd

is more or less parabolic in shape with varying side slopes. The depth is from 6 to 8 feet with an average width of about 50 feet. The channel meanders within the confines of the entrenched valley. Proceeding upstream, forest land decreases, pastureland remains constant and cropland increases.

Reach E of Jordan Creek begins at the Indiana-Illinois state line and proceeds upstream in Indiana to the junction of Little Jordan Creek.

Upstream from the state line the channel is shallow and flat bottomed about 50 feet in width and 3 to 1 side slopes with the flood plain being in cropland. The channel northwest of Pence, Indiana has a flat bottom with a double channel creating a wooded island and pastureland and cropland on the field sides. The channel is four to eight feet deep with varying side slopes from 2:1 to 4:1. The flood plain gains width and the entrenchment becomes shallower. The forest land is less dense but the reach contains a higher percentage than the remainder of the watershed. North and east of Pence to the end of Reach E the channel varies in width but averages approximately 4 feet in depth. The flood plain contains scattered trees and grasses with pastureland being the primary land use.

Reach C, beginning at the junction of Little Jordan Creek and ending at the junction of Leak Ditch, has a vee-shaped valley. The channel averages about 25 feet in width but is 4 to 7 feet deep with 2:1 side slopes. There are some trees scattered along the channel and limited pasture in the lower levels of the flood plain but the flood plain is predominately cropland.

Reach B beginning at the junction of Leak Ditch proceeding upstream on Jordan is no longer entrenched but is a drainage ditch with side slopes of about 2:1. The channel varies in width from 16 feet to 2 feet and is trapezoidal in shape with depths of 2 feet to 5 feet.

Reach A from the junction of Jordan Creek upstream on Leak Ditch is a drainage ditch and is trapezoidal with the following approximate dimensions: depth--4 feet, side slopes 2:1 and width 10 feet.

Reach D from the junction of Jordan Creek upstream on Little Jordan Creek is a drainage ditch, trapizoidal in shape, ranging in bottom width from 20 feet to 10 feet and having 2:1 side slopes with a depth of approximately 4 feet.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical data - cont'd

Reaches A, B and C, Leak Ditch, Jordan and Little Jordan Creek are manmade channels for removal of surface and subsurface water to enhance the agricultural development. Sedimentation has occurred in portions of these channels since their early construction.

There are no stream gages in the watershed. The nearest gage is downstream on Vermilion River at Danville, Illinois and serves an area of 1,280 square miles. Jordan Creek Watershed contributes only 10 percent of the drainage area of the gage.

The 100 year peak discharge on Jordan Creek at the watershed outlet is approximately 6,500 cfs, and about 1,890 cfs from Little Creek at its junction with Jordan Creek.

Groundwater resources

Groundwater resources are sufficient for local needs in the watershed. Locally good supplies are obtained from sand and gravel deposits located within the glacial drift. These sand and gravel deposits usually provide adequate water for rural, domestic and live-stock use. Well yields are normally in the range of 50 to 150 gallons per minute.^{1/}

The town of Pence, located near the lower end of Jordan Creek (one mile east of the Indiana-Illinois state line), has a municipal water supply system. Two wells drilled 115 feet deep supply 100 people with an estimated 36,600 gallons per day. The physical and chemical characteristics are as follows.^{2/}

	Unit	
pH	No.	7.0
Color (S.U.)	Color Units	5
Turbidity (S.U.)	Jackson Units	0.2
Hardness (CaCO ₃)	Mg/l	298
Calcium (Ca)	Mg/l	72
Magnesium (Mg)	Mg/l	28
Sodium (Na)	Mg/l	46
Potassium (K)	Mg/l	5
Iron (Fe)	Mg/l	0.8
Manganese (Mn)	Mg/l	0.04
Alkalinity	Meg/l	396

^{1/} Unpublished material prepared for the State Water Plan by the Groundwater Section, Division of Water, IDNR.

^{2/} Indiana State Board of Health, Data on Indiana Public Water Supplies, Bulletin #S.E. 10, 1968.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Groundwater resources - cont'd

Chlorides (Cl)	Mg/l	3
Sulfates (SO ₄)	Mg/l	2
Nitrates (N)	Mg/l	0.1
Fluorides (F)	Mg/l	0.3

The USGS, Water Resources Division in Indianapolis is conducting a water quality assessment and monitoring program for PL-566 projects. It is expected that this data will be available in time for inclusion in the draft work plan and draft environmental impact statement for Jordan Creek Watershed. The program is planned to satisfy all water quality requirements of the work plan and environmental impact statement.

Economic data

Principal economic activity in the watershed is agriculture. The agricultural area is under private ownership. Cash grain is the major farm enterprise. There are 324 farms in or partially in the watershed. One-hundred and eighteen are covered by cooperative agreement and have conservation plans with the Warren and Vermilion County Soil and water Conservation Districts. The average size farm is 320 acres with the average farming unit being about 480 acres.

Current overall watershed land use is distributed 33 percent to corn, 17 percent to soybeans, 17 percent to wheat, 23 percent to meadow, 2 percent to sweetcorn, 3 percent to permanent pasture and 5 percent to forest and other uses. Crop yields for the watershed as a whole average 100 bushels--corn, 30 bushels--soybeans, bushels--wheat, 3.0 tons--hay, and 4.5 tons--sweetcorn. Yields reflect a combination of productive soil, good management and adequate capital.

Land values vary in the watershed. The average value of upland is \$1,500 per acre, flood plain land is \$700 per acre and \$1,000 for land with drainage problems.

Access to trade and market outlets is provided through a well-developed network of roads. Indiana State Road 26 joins Illinois 9 to provide watershed access to points east and west. North-south traffic is served by Illinois State Road 1 to the west of the watershed and U.S. Highway 41 east of the watershed. Approximately 450 miles of county roads supplement these principal traffic arteries. Railroads serving the area are the Chicago and Eastern Illinois and the Penn Central.

Unemployment is not a problem in the watershed. Many of the farms employ full-time hired help or seasonal part-time help.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Plant and animal

The watershed contains approximately 92 percent cropland, 3 percent pasture land, 1 percent forest land and 4 percent other. The cropland is used primarily for production of corn and soybeans and is evenly distributed throughout the watershed.

A large portion of the pasture[#]land is found in the lower reaches of the watershed in the floodway. This pasture was originally established in the floodway to minimize crop losses caused by periodical flooding. The remainder of the pasture[#]land is evenly distributed throughout the watershed.

All of the forest land is privately owned with only 25 acres being located in Indiana and 587 acres in Illinois. The average forest land ownership is approximately ~~three~~³ acres in size. Forest land is unevenly distributed with concentrations in the downstream portions along the creek bottoms and adjacent upland. Stands are predominately hardwood with the principal forest type oak-hickory. About 70 percent of forest stands are sawtimber size, 10 percent pole size, and the remaining 10 percent understocked. Adequate forest fire protection is provided by the Indiana Department of Natural Resources in cooperation with the U.S. Forest Service through the Clarke-McNary Cooperative Forest Fire Control Program. Fire protection in the Illinois portion of the watershed is provided by local fire departments. The forest is uniform throughout the watershed with 50 percent occupying bottomlands and 50 percent uplands.

Wildlife habitat provided by the woody cover is limited in extent, however, it is quite desirable in quality for those wildlife species most predominant in the watershed. For the most part woody habitat is found adjacent to the streams and along railroad rights-of-way.

The IDNR, Division of Fish and Wildlife census information shows populations of cottontail rabbit light to moderate, bobwhite quail as light to moderate, ring-neck pheasant as moderate, squirrel as light, and deer as light over most of the watershed. This census information includes both the Indiana and Illinois portion of the watershed.

Ring-neck pheasant hunting is most important and accounts for over 80 percent of all hunting efforts in the area. Pheasants and bobwhite quail are common in grassy areas at the edge of woods, in the more open woods and throughout cornfields. Rabbit, squirrel and quail hunting comprises most of the hunting within the watershed.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Plant and animal - cont'd

Other important game and fur species which occur in the watershed include woodcock, raccoon, muskrat, opossum, striped skunk, red-fox, and mink. See Exhibit 9 for mammals occurring in the vicinity.

Pupulations of aquatic wildlife are light due to the general lack of wetland habitat throughout the watershed. However, several small type 1 wetlands are scattered throughout the topography in the form of depressional areas.

Songbirds of over 100 species use the limited woody cover which serves as a safe travel lane through large areas of cropland. Tall trees are nesting places for the great horned owl, redtailed hawk, Baltimore oriole, scarlet tanager and many others. Dead and mature hollow trees provide suitable nesting sites for woodchucks and invite flickers, redheaded woodpeckers, bluebirds, sapsuckers, house wrens and up to 35 other species of birds that use den trees. Shrubby border and fence rows attract the cardinal, mockingbird, catbird, cedar waxwing, brown thrasher, indigo bunting, goldfinch, song sparrow, vireo and chipping sparrow. See Exhibit 9 for species of wildlife identified within the watershed.

The U.S. Fish and Wildlife Service, Regional Director, stated that, "Most of Jordan Creek does not support a significant fishery, although the lower few miles of the main channel is influenced by the North Fork of the Vermilion River." The North Fork in this vicinity has an excellent sport fish population consisting of small-mouth bass, largemouth bass, channel catfish, yellow bullhead, white crappie, bluegill, longear sunfish, rock bass, grass pickerel, carp and suckers.

Jordan Creek upstream to its confluence with Little Creek is important as a nursery stream for the permanent fishery downstream. Little Creek and Jordan Creek upstream from their confluence may not support a year round fishery, but it is utilized in higher water periods in the spring.

A water quality study is being prepared by the U.S. Geological Survey, Water Resources Division, which will provide needed information concerning the influence of pollution and other water quality factors on the fish and wildlife resource values. The results will be available and included in the draft statement.

No rare or endangered species have been identified as being dependent upon habitat conditions in this watershed.

Most the land within the watershed is privately owned and public access to the existing resources is available only by permission of the landowners.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Recreational resources

There are no existing private or public recreational enterprises located in the watershed. The watershed is predominately agricultural with 92 percent of the land use being cropland and only 1 percent forest land.

No potential areas have been identified for major recreational development in Indiana.^{1/} However, to a limited extent, individual recreation activities such as bird watching and hiking exist along the lower reaches of Jordan Creek in Indiana. Hunting of ring-neck pheasant is common throughout the watershed.

The potential for recreational development in Illinois exists for the area encompassing the stream and extending from the confluence of the North Fork of Vermilion River upstream to the Indiana-Illinois state line. The valley is entrenched and wooded, having many scenic areas. This area could support a park.

There are existing needs for picnic areas, camping areas, playfields, bicycling paths, horseback riding trails, nature walks, hunting areas, swimming areas, and fishing waters in the watershed. The items mentioned would be consistent with the potential resources that exist within the watershed.^{2/}

Archaeological, historical and scenic resources

The following documents contain no entries of historical and archaeological sites within the watershed: National Register of Historic and Archaeological Sites, compiled by the National Park Service; Natural Areas in Indiana and Their Preservation, Purdue University, April 1969; Natural Areas Study of the Wabash River Basin Comprehensive Study, Vol. X, Appendix I, June 1971.

The Indiana Historical Society is conducting a detailed survey along the proposed works of improvement. At the writing of this report, the Society had not furnished the results of their study. The results will be available and included in the draft work plan and environmental impact statement.

^{1/} Warren County Soil and Water Conservation District, An Appraisal of Potentials for Outdoor Recreational Developments in Warren County, Indiana.

^{2/} State of Indiana, Shaping the Future, Indiana Recreation Plan, September 1970.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Soil, water and plant management status

The present trend in land use is essentially stable with only a slight increase each year in cropland with an accompanying decrease in pasture, forest land and other land. The projected land use changes during the life of the project are summarized below:

	<u>Cropland</u>	<u>Pasture</u>	<u>Forest Land</u>	<u>Other Land</u>
Present	70,240	2,560	612	2,940
Future	70,757	2,270	390	2,935
Change	+ 517	- 290	- 222	- 5

The change in land use as indicated above is attributable to economic and technical conditions rather than project action. Some factors involved in the change are: The high cost of land, equipment, labor, and capital. These factors have combined to encourage the farm operator to specialize (produce one commodity) instead of diversify (produce several commodities). The comparatively low profit margin in livestock production is expected to result in the conversion of some pasture to cropland. Also, long term investment pressures and a general shortage of readily available or accessible cropland will tend to encourage the farm operator to remove timber from the present forest land that can be used as cropland. In summary, the projected change in land use is not project oriented.

Adequate local funds are available for applying needed individual farm land treatment practices. There is a shortage of local contractors to apply conservation practices.

Approximately 50,000 cropland acres of mineral upland soil have an inherent drainage problem that has been partially corrected. Additional drainage is needed for most efficient use of this land as cropland.

Soil loss on 21,700 acres of gently to moderately sloping cropland exceeds tolerable limits. This excess soil loss decreases the productivity of the land and increases production costs of crops, and contributes to downstream sediment pollution. Adequate conservation practices will be applied to reduce average annual soil loss to a tolerable limit of 3.5 tons per acre.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Soil, water and plant management status

The watershed is serviced by the Warren County Soil and Water Conservation District in Indiana and Vermilion County Soil and Water Conservation District in Illinois, which provides technical assistance to landowners and operators in the preparation of conservation plans and the application of land treatment measures.

Adequate forest fire protection is provided in Indiana for the forest land by the IDNR, Division of Forestry in cooperation with the U.S. Forest Service through the Clarke-McNary Cooperative Cooperative Forest Fire Control Program.

The Illinois portion of the watershed is outside the state's forest fire protection zone. Adequate forest fire protection is provided for this area by the local fire departments.

There are 324 farms in the watershed and 118 (36 percent) of the farms have conservation plans with the soil and water conservation district.

Acres and percentages of land considered adequately treated by land use are: 12,800 acres cropland, 19 percent; 330 acres pasture, 10 percent; 25 acres forest land, less than one percent; and 639 acres other, 12 percent. This represents 13,794 acres which comprise 18 percent of the total watershed.

Conservation practices needed in the watershed which are presently applied on the land are as follows:

<u>Practice</u> ^{1/}	<u>Practice Unit</u>	<u>Percent Applied</u>
Contour Farming	Ac.	(68%)
Grade Stabilization Structure	No.	(30%)
Grassed Waterway or Outlet	Ac.	(46%)
Conservation Cropping System	Ac.	(33%)
Minimum Tillage	Ac.	(27%)
Crop Residue Use	Ac.	(34%)
Subsurface Drains	Ft.	(84%)
Pasture and Hayland Management	Ac.	(53%)

^{1/}See Exhibit 1 for definition of practices

Cost sharing for some conservation practices is available through the Agricultural Stabilization and Conservation Service which administers the Rural Environmental Conservation Program.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land and water management

Many areas of the watershed now under cultivation have soils with erosion problems and drainage limitations. The ability of these soils to sustain efficient production depends on the establishment and maintenance of needed conservation measures. (See Exhibit 2)

Flooding and drainage is a problem on approximately 16,800 acres in the watershed. The average annual area subject to overbank flooding is 2,117 acres.

Most severely affected within the water problems area are scattered surface depressions and low areas adjacent to inadequate channels. Damaging effects are expressed through impaired root and plant growth, increased disease, greater competition from weeds, reduced crop quality, and delayed field work. Low economic returns do not permit the landowners to apply management for top efficiency.

Overall economic capabilities of landowners and operators present no limitation to application of conservation practices. There is a need for additional conservation contractors, however, this factor is not expected to seriously delay implementation of needed practices.

There is a continuing need for information and education programs to effectively reach and motivate the landowners and operators who must carry out the land treatment measures.

Floodwater damage

Frequent flooding occurs on land adjacent to principal watershed drainage channels. Flood problems are most severe on Leak Ditch from the vicinity of Tab, Indiana, (Reach A) downstream to its junction with Jordan Creek; on Jordan Creek from Tab (Reach B) downstream to its confluence with the Middle Branch (Reach H); and on Little Creek (Reach D) from the vicinity of Stewart, Indiana, downstream to its junction with Jordan Creek.

Areas flooded vary in width from a few hundred feet to a maximum of one quarter mile. Approximately 2,359 acres of land within the watershed are inundated by a large flood (100 year frequency), 1,445 acres by a medium size flood (5 year frequency), and 814 acres by a small flood (1 year frequency).

WATER AND RELATED LAND RESOURCE PROBLEMS

Floodwater damage - cont'd

Land use within the flood plain is primarily agricultural. Of the total area subject to flooding 45 percent is cropland, 42 percent pasture land, and 13 percent woodland and other land uses. Corn occupies two-thirds of the cropland acreage and soybeans one-third.

Greatest concentrations of cropland occur along Leak Ditch and Jordan Creek in the vicinity of Tab, along Jordan Creek from the Indiana-Illinois state line downstream approximately two miles, and along Little Creek. Cropland in these areas accounts for 70 to 75 percent of the floodplain. Cropland in other flood plain areas ranges from 35 percent on Jordan Creek Reaches C and E to 15 percent on the most downstream segments of Jordan Creek.

Damages occurring on agricultural areas from overflow include reduced crop and pasture yields, increased crop production costs, and increased maintenance expenses on flood plain improvements. Annual value of future crop and pasture damages without project average \$11.47 per flood plain acre. Constraints to flood plain land use and crop production processes are a factor on Jordan Creek (Reaches C and E) and on the upper two miles of Reach F.

Flood damages to non-agricultural values are reflected primarily as increased road and bridge maintenance expense. In total, 17 county roads and 8 railroad bridges cross the channels within the flood zone outlined at the beginning of this section. Damages on an annual basis are, for the most part, insignificant on railroad bridges and those county road bridges located in Jordan Creek (Reach H) and the lower one-half of Reach F. Damages to county roads and bridges in the remainder of the flood plain area typically occur yearly.

Erosion damage

Erosion is not a severe problem in the watershed. The greatest soil loss occurs on about 21,700 acres of cropland which is susceptible to sheet erosion. The estimated average soil loss is 3.9 tons per acre annually. The average soil loss tolerance is approximately 3.5 tons per acre annually. About 50,000 acres of cropland occur on depressional soils which normally yield very minor quantities of sediment. The estimated average soil loss from the total cropland acreage in the Indiana portion of the watershed is about 1.4 tons per acre annually.

WATER AND REALTED LAND RESOURCE PROBLEMS

Erosion damage - cont'd

Streambank erosion contributes an estimated 5 percent of the gross erosion. Erosion from roadside ditches, built-up areas, and farmstead sites contribute an estimated 5 percent of the total gross erosion within the watershed. There is some wind erosion within the watershed due primarily to fall plowing, a common practice in the watershed.

The major soil erosion areas are scattered throughout three of the five soil associations (Sidell-Dana, Dickerson-Benton, and Blount-Fincastle). The associations paralleled the streams throughout the watershed and extend along the east edge of the watershed in Indiana.

Sediment damages

Sediment damages are not a severe problem. Some roadside ditches and drainage channels accumulate sediment, however, the problem is minor in relation to the total floodwater and drainage problems. Improved agricultural management practices and the application of needed land treatment measures should alleviate the problem of sediment accumulation in roadside ditches and drainage channels.

Sediment yields from the Indiana portion of the watershed are estimated at approximately 12,000 tons annually (about 0.33 tons per acre annually).

Sediment yields from the Illinois portion of the watershed are estimated at approximately 9,000 tons annually (about 0.21 tons per acre annually).

Joint problems (flooding and drainage)

Agricultural drainage problems exist because of shallow channel depths and lack of channel capacity. Open and closed drains are restricted during flood events. The most significant problems are recurring patterns of drainage impairment and flooding occurring throughout the growing season. Damaging effects are expressed through impaired root and plant growth, increased disease, greater competition from weeds, reduced crop quality and delayed field work. Reach A contains 2,107 acres with joint problems; Reach B, 4,521 acres; Reach C, 1,709 acres; Reach D, 4,715 acres; Reach E, 2,368 acres; Reach F, 876 acres; and Reach J, 504 acres.

WATER AND RELATED LAND RESOURCE PROBLEMS

Joint problems (flooding and drainage) - cont'd

Due to the existing flooding and drainage problems, crop production costs are higher and crop yields are lower when compared with production on land without these problems. Thus, less maintenance, labor and material are applied by landowners and operators in the area. Average annual yields in the area affected by poor drainage outlets are reduced by an estimated 26 bushels per acre for corn and 12 bushels per acre for soybeans.

The lack of adequate drainage outlets on the upper reaches of Little Creek, Leak Ditch and Jordan Creek has resulted in a large portion of these drains becoming unservicable. In some sections drains are now inadequate for either passage of floodwater or to serve as suitable drainage outlets. Additional depth and capacity are needed to provide adequate outlets on the upper reaches of all three tributaries.

Most severely affected within the water problem area studied are scattered surface depressions and low areas adjacent to inadequate channels. These areas for ease of future discussion will be labeled Problem Sub-Area 1. Storm runoff concentrates in these areas, remaining for prolonged periods of time. Crop yields are greatly reduced, often with complete crop failure resulting.

Surrounding these areas of severe water problems are fringe areas of soils which, although not subject to ponding or flooding, remain saturated for long periods of time (Problem Sub-Area 2). Yields in these areas, although acceptable, do not reflect the inherent production potential of the soil. Row crop yields are depressed on an average of 20 to 30 percent due to the drainage problems present.

Reduced crop yields are experienced on still other portions of the overall water problem area. These areas are designated here as Problem Sub-Area 3. This area often occurs on the landscape in close association with Problem Sub-Areas 1 and 2; but many occur separately as well. For the most part, their margins follow normal field boundaries. They represent areas where less than optimum timing of field operations are possible due either to the presence of Sub-Areas 1 and 2 within a given field, or the presence of random areas of imperfect drainage when occurring as independent problem sub-areas. Extent of current yield reductions on these areas is not highly significant 5 to 10 percent. However, with an ever increasing level of technology, it is expected that the yield limitations presented by disruptions in the timing of field operations will become increasingly more significant.

WATER AND RELATED LAND RESOURCE PROBLEMS

Recreational problems

Individual recreation activities such as hunting, bird watching, hiking, nature walks, fishing and picnicking, with the landowners' permission, are the only activities available to the general public in the watershed.

There are no surface water areas in the watershed for use by the public. There are four privately existing ponds in the watershed, two in Indiana and two in Illinois.

The watershed is in the Bureau of Economic Analysis Area 058 and 059. Warren County (Indiana) lies in Area 059 which has a projected population of 388,800 for the year 2,000 compared to 249,412 in 1969. Vermilion County (Illinois) lies in Area 058 which has a projected population of 598,700 for the year 2,000 compared to 388,784 in 1969.

Present recreation needs for these areas include the following facilities: hunting areas, nature and hiking trails, horseback riding paths, bicycling paths, camping areas, and picnicking areas. Needs exist for water-related activities such as fishing, swimming, boating, water skiing, and canoeing. There appear to be available resources to meet all needs except for water-related recreation.^{1/}

Plant and animal problems

The original vegetation for the area was primarily prairie grass. The minimal amount of forest land and wildlife and recreation land present provides very limited cover for wildlife. The Chicago and Eastern Railroad right-of-way is in the process of being returned to cropland by private owners. The loss of the old railroad right-of-way along with channel improvement clearing for flood control and drainage will be detrimental to the existing wildlife resources. A continuing detrimental effect will last the life of the project unless redevelopment is planned, established and maintained. An improved balance of land use to provide fish and wildlife habitat is desirable.

Since 92 percent of the watershed is cropland, the wildlife will be substantially influenced by the agricultural land use and management practices. Farm ponds, wildlife habitat development and other vegetative erosion control practices are beneficial to wildlife existence.

^{1/}State of Indiana, Shaping the Future, Indiana Recreation Plan, September 1970.

WATER AND RELATED LAND RESOURCE PROBLEMS

Plant and animal - cont'd

The forest land ownership pattern is small and scattered with only 612 acres existing in the watershed. The narrowness and limited length of much of the wooded areas along the streams reduce their importance for large mammals, such as white-tailed deer, but small mammals, birds, reptiles and amphibians make use of these areas. The present hydrologic condition of the forest land varies from very poor to poor; however, the potential of this land to improve hydrologically is high. Livestock grazing has eliminated ground cover in certain areas, exposing the soil to erosion; however, erosion and sediment yields are minimal. The primary problem is bringing woodland under improved management.

The watershed is short of surface water habitat for fish, wildlife, and recreation. Any substantial increase in installed and managed fishery waters would benefit these resources.

A water quality study is being prepared by USGS, Water Resources Division which will provide needed information concerning influence of pollution and other water quality factors on the fish and wildlife resource values. The results will be available and included in the draft environmental impact statement.

Economic and social

The median income per family in Warren County, Indiana, for 1970 was \$8,340. The median income per family for the State of Indiana in 1970 was \$9,970. The median income for all farm families in the county was \$8,293 and for the state was \$8,198.^{1/}

The median income per family in Vermilion County, Illinois for 1970 was \$9,449. The median income per family for the State of Illinois in 1970 was \$10,959. The median income for all farms in the county was \$9,792 and for the state was \$9,280.

Water quality problems

Water quality is not considered to be a problem in this watershed; however, the USGS, Water Resources Division in Indianapolis is conducting a Water Quality Assessment of the watershed. Results will be included in the draft environmental statement.

^{1/}U.S. Department of Commerce, General Social and Economic Characteristics, 1970

PROJECTS OF OTHER AGENCIES

Lake Vermilion, the 690 acre major water supply for Danville, Illinois, is located on the North Fork of Vermilion River 13 miles downstream from Jordan Creek. No benefits are expected to accrue to the Jordan Creek project from Lake Vermilion. However, the installation of sediment traps during construction of Jordan Creek, immediate revegetation of disturbed areas during construction, and the long term effect on reduction in sediment delivery downstream from Jordan Creek as a result of installation of additional land treatment measures should enhance the Lake Vermilion project.

(The Jordan Creek Watershed project is an action-pending project for the Comprehensive Coordinated Joint Plan (CCJP) developed by the Ohio River Basin Commission for the Wabash Basin. Adoption into the CCJP is expected upon completion of the final work plan and environmental impact statement.)^{1/}

There are no other water resource development projects in operation or being considered by other agencies or groups that would affect or be affected by the installation of measures proposed in this work plan.

^{1/} Wabash River Basin Comprehensive Study, Vol. 1, Main Report,
June 1971.

PROJECT FORMULATION

Introduction

Relief from standing water and the need for improved drainage has long been recognized as a need for the Jordan Creek Watershed. Action to provide relief for the Indiana portion of the watershed was initiated in the mid-forties. Records indicate that the Soil Conservation Service was contacted at that time to study the needs and provide a solution for the problems of water management.

An application for planning assistance under PL-566 for the Indiana portion was submitted in 1959. This application was not approved by the SCS since there could be no provisions to include the Illinois portion for overall formulation and it was believed that the Illinois portion was needed for an outlet for any work in Indiana.

An amended application was prepared in 1964 that included the entire drainage area of the watershed. This application was approved by the Illinois Department of Agriculture and the Indiana Department of Natural Resources. Subsequent approval was given by the SCS on August 1964.

A Preliminary Investigation Report was completed on September 1967. The report emphasized work on channels. Work was considered for about 10.5 miles of Main Jordan to within about 2 miles of its junction with Middle Branch. Also considered was about 2.4 miles of Little Creek and 3.9 miles of Leak Ditch in Indiana and 7.7 miles for Middle Branch, mostly in Illinois.

To carry out the general formulation of the Preliminary Investigation Report, the Jordan Creek Conservancy District in Indiana was organized February 1969. An effort to form a similar organization in Illinois failed through referendum vote.

The watershed was authorized for planning by the SCS on April 1969.

First, there was a need for a adequate sponsor in Illinois to carry out any works of improvement that were necessary in that state for overall watershed development. It was finally agreed that the Pleasant Hill Drainage District would provide the necessary sponsorship for the main Jordan Creek work and a small amount for lateral work that would be done in Illinois.

A series of discussions involving personnel from Indiana Department of Natural Resources, Illinois Department of Conservation, Fish and Wildlife Service, Soil Conservation Service, and local interests were .

PROJECT FORMULATION

Introduction - cont'd

held throughout 1971. The purpose of these meetings was establishment of criteria as provided in a 1971 SCS memorandum for mitigation of fish and wildlife losses resulting from project action.

Stability of the main channel where work was proposed was a matter of concern. Additional soil borings were done in 1970. Calculations for stability analysis were made in the late part of 1971. At a meeting of SCS personnel held September 1972 at the SCS Technical Service Center at Lincoln, Nebraska agreement was reached for the appropriate methods to cope with the potentially unstable condition resulting from planned channel modification.

In June 1972 an initial plan consisting of 43.0 miles of open channel improvement; 58.5 miles of surface drains and grassed waterways; and 20.5 miles of tile drains with some surface drains and grassed waterways was developed. The work on the main channel extended down to the Chicago and Eastern Illinois Railroad about 5 miles east-southeast of Rossville, Illinois. Most of the benefits accrued to the Indiana portion of the watershed resulting from the installation of the upstream measures. The general design of the planned water management features emphasized a fairly fast excess water removal rate.

The planned project caused induced flows along the lower reaches of the main channel, especially for the infrequent, high volume rainfall events. The Pleasant Hill Drainage District attempted but was not able to obtain required flowage easements below the project cutoff where induced flows were estimated to occur.

A meeting was held at Williamsport on January 17, 1974. Inability to obtain the required easements was discussed. The sponsors requested the SCS to study on alternatives to the June 1972 draft that could eliminate the problem caused by downstream induced stages and the land rights situation.

On September 11, 1974 a meeting was held at Pence, Indiana with local people and SCS personnel from both states in attendance. A project alternative was discussed whereby most of the main channel work would be eliminated from a point about three miles upstream of the state line and to the cutoff of the June 1972 draft plan at the Chicago and Eastern Illinois Railroad. Remaining channel work would be reduced in size to diminish the rapid water removal rate that was previously planned. In addition, the land treatment program would receive greater emphasis for those practices that would reduce surface runoff.

PROJECT FORMULATION

Introduction - cont'd

The overall effects would reduce greater project-induced flows and eliminate any induced flows across the state line. The sponsors agreed that this approach provided the best means to implement needed project measures for the solution of their water management problems.

Objectives

The project sponsors expressed as objectives for development in the Jordan Creek Watershed the following items: 1) reduce flood damages, 2) improve drainage, 3) reduce road and bridge damage, 4) control erosion and sedimentation, 5) improve fish and wildlife habitat and 6) develop outdoor recreation facilities.

The soil and water conservation district will encourage methods for erosion and water runoff control. Their goal is to have at least 49,400 acres (65 percent) of the total watershed area adequately treated by the end of the project installation period.

Another goal of the sponsors is to provide for the safe and timely removal of excess water from flood plain and depressional areas. The opportunity for subsurface water removal for all areas in need is also desired as a part of project works of improvement.

The primary concern of residents along the major channels is relief from flooding. A one year cropping season level of protection is considered adequate to meet their needs. Complete water removal from all other areas within a 24 hour period is the general objective of the sponsors.

Methods of solving the watershed problems, other than channel improvement, were considered during work plan studies. The watershed topography is too level to allow the use of retarding structures. One dam was studied near the lower end of the watershed below the Middle Branch junction, and downstream from all planned structural measures. Lack of floodwater storage and local interest in other uses eliminated the site from consideration.

The sponsors recognize the value of conserving fish and wildlife resources consistent with proper use of soil and water resources. Their objective is to retain and enhance as much habitat as possible.

PROJECT FORMULATION

Environmental Considerations

Modification of the previously selected works of improvement was required as a result of the National Environmental Policy Act in which Congress directed that "to the fullest extent possible, the policies, regulations and public laws of the United States shall be interpreted and administered in accordance with policies set forth in the Act." The passing of this Act presented the need to review and give full environmental consideration to all watershed work planning.

Additional detailed survey data was obtained which indicated that channel work could be omitted in various reaches, thus minimizing disturbance to existing wildlife habitat. Destroyed habitat will be mitigated and enhanced through installation of vegetative treatment measures, management of forest land, protection of woody habitat and idle land within the permanent easement, planting of trees and shrubs, and grasses and legumes.

Soil erosion is considered minor, however, sheet erosion during high intensity rains results in delivery of sediment and soil fertility to streams and waterways. The progressive and on-going land treatment programs will control soil erosion on those acres adequately treated. This control will result in reduced waterways thereby reducing one source of water pollution.

Several acres within the floodway and flood plain receive flood-water damages, one to three times annually, resulting in reduced crop and pasture yields, increased maintenance expenses for county roads and bridges. The selected plan will reduce flooding stages in Indiana on the more frequent floods. Flooding will continue to occur in Illinois at present stages.

Alternatives

1. Main channel and tributary improvements as proposed in the initial plan. This alternative would provide essentially the same drainage benefits as the planned project; flood benefits would be realized. There would be increased adverse environmental effects along Main Jordan Creek downstream of the state line as a result of destruction of valuable woody habitat or fishery habitat. The installation costs would be \$2,017,000. This alternative was eliminated when Illinois sponsors were unable to assure land rights for induced damage areas downstream of the project.

PROJECT FORMULATION

Alternatives - cont'd

2. Installation of subsurface drainage pump system. The estimated construction cost is \$1,047,800. This alternative is the installation of pumping stations where subsurface drainage is impaired. Basins would be constructed to serve as a collection point for the subsurface drain tiles. The pumps would then lift the water into existing drainageways. Discharge from pumps will be compatible with needed subsurface water removal.

Periodical flooding would continue along those drainageways. Installation of this alternative would require only minor channel excavation, thus nullifying most adverse affects on wildlife resources. The average annual cost of this alternative would be \$242,880. Induced flooding would occur.

3. No PL-566 project--no local action. The on-going land treatment program will in time reduce sediment contribution to Jordan Creek and Little Creek, however, floodwater and drainage will continue to cause damages. The estimated net annual monetary benefits that would be foregone by not implementing the planned project are \$385,137.

Drainage and flooding relief have been a concern to the local people for nearly 30 years. It is likely they would attempt to obtain relief through minor channel work where determined needed and feasible. However, the local people are not required to give as full consideration to environmental criteria as the planned PL-566 project.

4. Land treatment only. An accelerated land treatment program will reduce erosion, thus sediment contribution to Jordan Creek and Little Creek. Properly selected and installed land treatment measures will slightly reduce runoff, however, the floodwater damages would remain nearly identical to present conditions. Drainage will remain unimproved and continue to cause damages as proper outlets would not be available. This alternative would have minimal adverse environmental affects on wildlife resources. The estimated net annual monetary benefits that would be foregone by not implementing the planned project are \$399,400.

5. General discussion. The proposed planned project is essentially a land treatment program. The project consist of the installation of planned conservation land treatment along with minor channel improvement where needed to obtain subsurface drainage outlets.

PROJECT FORMULATION

Alternatives

5. General discussion - cont'd

Soil erosion is not a severe problem in the watershed. However, erosion control and reduced sedimentation will occur as a result of the land treatment program. Through establishing and maintaining needed conservation measures most soil limitations will be overcome, resulting in more efficient production. The portion of the watershed in Illinois will continue the present on-going land treatment program.

A network of grassed waterways, surface drains and subsurface drains will provide drainage and flooding benefits to much of the area in Indiana and the Pleasant Hill Drainage District. Local sponsorship for the Illinois portion of the watershed was not obtained, thus the selected plan does not provide floodwater control across the state line. Downstream flooding will continue to occur in Illinois at present stages.

Many local landowners are interested in developing available recreational resources for public use. The available resources are concentrated along the lower reaches of Jordan Creek in Illinois. When Illinois failed to obtain local sponsors, the available recreational resources for development were lost. No adequate resources are present in the Indiana portion of the watershed.

Full environmental considerations were given to the selected plan. All adverse affects have been carefully studied with proper procedures taken to reduce their impact upon the total plan.

The installation of this project will improve the quality of life and increase the demand of businesses within the area.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land treatment measures

An accelerated land treatment program will be installed on the Indiana portion of the watershed. Land treatment in Illinois will continue at the on-going rate of application.

The land treatment measures to be installed during the eight year project installation period includes conservation practices on 35,347 acres of cropland, 185 acres of pasture, 20 acres of forest land and 15 acres of other land. Adequate treatment will be achieved on 49,400 acres covering 65 percent of the total watershed at the end of the installation period. The Indiana portion plus the Pleasant Hill Drainage District in Illinois (the area above structural measures) will have 36,700 acres or 95 percent, under adequate treatment at the end of project installation.

Conservation practices to be applied on cropland include contour farming, terraces, diversions, grassed waterways or outlets, minimum tillage, crop residue use, grade stabilization structures, sub-surface drains, and drainage mains or laterals.^{1/} A combination of two or more practices are often needed to achieve adequate treatment of land. Land treatment practices such as waterways, diversion, pasture planting and management, and tree planting will benefit wildlife. The Soil Conservation Service Technical Guide will be used in planning alternatives for adequate land treatment.

Pasture land treatment measures to be installed include pasture and hayland planting and pasture and hayland management.

Forest land treatment measures to be installed are tree planting on open lands where necessary to control erosion, and adjust land use to land capability throughout the watershed. Adapted species for planting will be recommended by the Indiana Department of Natural Resources (IDNR), or the Illinois Department of Conservation-Division of Forestry in cooperation with the U.S. Forest Service. Hydrologic conditions will be improved by manipulation of stand composition, protection from grazing and implementing management plans. The multiple-use forest land treatment program was cooperatively developed by IDNR, Division of Forestry and the U.S. Forest Service

^{1/} See Exhibit 1 for definition of practices.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land treatment measures - cont'd

The sponsors estimate that 40 additional landowners or operators will become cooperators with the soil and water conservation district and develop conservation plans during the project installation period.

At present, 25,000 acres of the Indiana portion and 15,000 of the Illinois portion of the watershed have been soil mapped. Plans are to map an additional 11,200 acres in Indiana and 2,000 acres in Illinois during the installation period.

The SCS will provide the needed technical assistance for soil surveys, conservation planning and application of conservation practices. Land treatment will consist of voluntary actions taken by individual landowners or operators.

Structural measures

The structural measures consist of approximately 12.2 miles of main channel work with 4.4 miles on Jordan Creek, 5.7 miles on Little Creek and 2.1 miles on Leak Ditch. Tributary structural measures consist of approximately 15.3 miles of new or reconstructed open ditches, 48.6 miles of surface drains, 5.1 miles of grassed waterway construction, 19.8 miles of tile in conjunction with surface drains and grassed waterways, and approximately 50 grade stabilization structures to provide controlled inlets for grassed waterways and surface drains into main channel and improved open ditches.^{1/}

Main channels

Main channel work consists of channel enlargement and where necessary minor realignment. Construction on the Jordan Creek main channel starts near the center of Section 6, T22N, R9W, 1,800 feet downstream from a New York Central Railroad bridge and extends upstream to the junction of Jordan Creek and Leak Ditch located in the northwest quarter of section 32 T23N, R9W. The work commences again on Jordan Creek main channel in the northeast quarter of section 17, T23N, R9W, 1,150 feet upstream from a county road bridge and continues upstream to State Road 26. Little Creek construction

^{1/} The term "surface drains" is an accepted local term which includes SCS specifications for Drainage Mains or Laterals (480) Open Channel(582).

WORKS OF IMPROVEMENT TO BE INSTALLED

Structural measures - cont'd

extends from a county bridge on the west line of Section 7, T22N, R9W upstream to the center of Section 22, T22N, R9W. Leak Ditch construction will start west of Tab at a county road bridge located near the center of section 30, T23N, R9W and continue upstream 5,600 feet to a county road bridge located on the west line of the southwest quarter of Section 19, T23N, R9W. Construction starts again 1,470 feet upstream from a county road bridge and is located approximately 1,000 feet east of the center of Section 18, T23N, R9W. Construction continues upstream to Indiana State Road 26.

The main channel improvements traverse primarily through glacial till in Reaches A, B, and D. Through Reaches C, E, and F the glacial till is present in exposed banks of the channel but is covered with glacial outwash in the valley which contains lenses of silts, clays, and gravels. Armor plating will be used to protect those soils encountered that are erosive or unstable due to the velocities within the channel.

Main channel design discharges were furnished by the planning hydrologist for Jordan Creek main through Reaches C, E, and F, and for Leak Ditch and Little Creek through the lower parts of Reaches A and D, respectively. Design discharges for the remaining portions of the project are based on good agricultural drainage and the flood control provided by a 1-year cropping season level of protection. Less intense use of the rather narrow flood plain downstream from construction dictated less protection and, finally, termination of channel work.

The channel work will deepen the existing channel for drainage and also widen it where additional capacity is required. Channel work is planned to follow existing alignment. Excavation will be done from one side to reduce damage to wildlife habitat (exhibit 4). Significant trees will be left standing on the constructed side, if at all practicable, during operations. In isolated cases where slope protection is required on the opposite bank, work may be done from both sides. All flow impeding brush and unstable or fallen trees will be removed from both banks. Removal will be carried out from the side designated for spoil. Armor plating (gravel blanket) will be used to protect unstable soils on the bottom and sides of the channel. The berm will be used as a maintenance travelway. A 15-foot vegetated buffer strip will be maintained on the unconstructed side to protect the channel from farming operations and also serve as a travel lane for wildlife.

WORKS OF IMPROVEMENT TO BE INSTALLED

Structural measures - cont'd

Fence will be installed to protect vegetative cover where there is a potential for livestock use of the area adjacent to the channel. Markers will be used to delineate the boundaries of wildlife plantings and vegetative buffer strips (Exhibit 4). Openings will be left in the spoil to avoid induced stages on the unconstructed side. Appurtenances are planned for all reaches to safely lower surface water into channels. All existing tile outlets disturbed by construction will be replaced.

Work, as necessary, will take place on the unconstructed side to install appurtenances. Appurtenances on Little Creek include the construction of a multi-plate pipe arch approximately 96" x 159" to replace a county road bridge located on the North line of Section 20, T22N, R9W. The purpose of installing the pipe arch is 50 percent flood control and 50 percent drainage with the flood control benefits being the elimination of induced flooding downstream of the road bridge. Care will be taken to minimize the disturbance of wildlife habitat.

The 1.5 miles of minor debris removal on Jordan Creek main channel runs from a point approximately 0.8 miles upstream of the Indiana-Illinois state line to the junction of Jordan Creek main channel and Little Creek, a distance of about 1.5 miles. The work involves mostly the removal of one log jam and the work will not affect the stability of the channel. The work will be done so as to minimize the disturbance of wildlife habitat. The interdisciplinary team will be consulted where debris removal is anticipated.

Care will be exercised to minimize the amount of construction sediment. Sediment traps will be installed as needed. Cleared material will be buried or disposed of by other acceptable means.

Land rights on main and tributary channels will consist of approximately 194 acres of permanent easements and approximately 455 acres of temporary easements. The permanent easement area will consist of approximately 69 acres of other land,^{1/} 48 acres of woody vegetation, and 69 acres of cropland. The temporary easement area is in cropland. These areas will not be available to the public without the permission of the landowner.

Woody vegetation will be established and maintained within the permanent easement area to mitigate approximately 27 acres of woody wildlife habitat destroyed by the structural improvements. A strip of trees and shrubs approximately 10 feet in width will be planted

^{1/}Other land includes - channel bottom and side slopes and areas providing wildlife habitat adjacent to the channel.

WORKS OF IMPROVEMENT TO BE INSTALLED

Structural measures - cont'd

within the permanent easement on the spoil area. The vegetated buffer strip on the unconstructed side of the channel, within the permanent easement, includes existing woody material that can be utilized for wildlife habitat. Approximately 56 acres grasses and legumes will be seeded on the disturbed areas within the permanent easement on the main channel.

Condensed profiles of the planned channel work are attached as Exhibit 6.

A variety of materials will be encountered during construction. A general description of materials, by reach, is tabulated below:

JORDAN CREEK

Reach B

101+00 to 235+00 -- Predominantly glacial till silty clay (CL) overlain by thin weathered till (ML or CL). Plasticity indices estimated to range between 10 and 20.

Reach C

410+86 to 508+00 -- Predominantly glacial till silty clay and silt (CL and ML) overlain by silt (ML) and clayey silts (ML or CL) with plasticity indices ranging between 10 and 20. Sands, gravel, silty sand and sandy silt near bottom in some areas (SC, ML, SM).

LEAK DITCH

Reach A

8+00 to 65+00 -- Predominantly silty and sandy clay glacial till with estimated plasticity indices ranging from 10 to 20.

170+12 to 226+22 -- Three to five feet of surficial glacial till (CL) with estimated plasticity indices of 10 to 20, overlying loose wet sand and clayey sand (SC, CL and SP).

LITTLE CREEK

Reach D

23+60 to 225+00 -- Predominantly glacial till; 3-6 feet of firm, dense sandy and silty clay (CL) overlying wet, soft sand, silt and clay (SM, SC, ML and CL), in turn overlying firm, moist, sandy clay (CL).

WORKS OF IMPROVEMENT TO BE INSTALLED

Structural measures - cont'd

225+00 to 323+24 -- Sandy clay and silty clay (CL) overlying soft wet sandy clays and sandy silts (ML, CL, SM and SC).

Tributary structural measures

The tributary open ditch work will deepen (reconstruct) and construct (new) about 15.3 miles of channel. The open drains will be located as shown on the project map, exhibit 12. The work will be to provide surface and subsurface drainage outlets. The open drains will have a bottom width of 4 feet, 2:1 or flatter side slopes, and shaped spoil banks. In areas where wildlife habitat exists, construction will be in accordance with exhibit 4. A picture of a typical open drain is shown on exhibit 2.

The tributary work also includes approximately 48.6 miles of surface drains. Those with drainage areas less than 640 acres will be constructed in accordance with SCS specifications for Drainage Mains or Laterals (480) and those with drainage areas greater than 640 acres will be constructed in accordance with SCS specifications for Open Channels (582). The bottom width will vary from 8 feet and larger. Side slopes will be 4:1 or flatter and depths will vary from 1 foot to about 3 feet. The purpose of the surface drains is to remove surface water that otherwise would pond and cause crop damage. A picture of a typical surface drain is shown in exhibit 2. The surface drains will be located as shown in the project map, exhibit 12.

Five and one-tenth miles of grassed waterways will be constructed in locations as shown on the project map, exhibit 12. The grassed waterways will be constructed in accordance with SCS specification 412. The cross sections will be parabolic with depths of 1 to 3 feet.

About 19.8 miles of tile with a diameter of 8 inches and larger will be installed in locations as shown on exhibit 12. The tile will be installed in accordance with SCS specification 606. A typical tile installation is shown in exhibit 2.

EXPLANATION OF INSTALLATION COSTS

The costs of installing the land treatment measures are summarized in Table 1. Estimated total cost for technical assistance is \$69,170, of which \$68,470 will be paid from Soil Conservation Service funds (PL-566 - \$18,640) and \$700 from Forest Service funds. Landowners and operators will spend an estimated \$844,520 for measures installed on their lands.

The estimated schedule of PL-566 and other obligations for installation for the land treatment is indicated as follows:

FISCAL YEAR	PL-566		OTHER FUNDS	
	IND.	ILL.	IND.	ILL.
1st	2,330	---	5,200	1,029
2nd	2,330	---	5,200	1,029
3rd	2,330	---	5,200	1,029
4th	2,330	---	5,200	1,029
5th	2,330	---	5,200	1,029
6th	2,330	---	5,200	1,029
7th	2,330	---	5,200	1,029
8th	2,330	---	5,200	1,029
TOTAL	18,640		41,600	8,232

Structural measures

Installation costs for structural measures as shown in table 2 include construction, land rights, engineering and project administration costs. The table shows the total PL-566 and Other costs.

Construction costs is the estimated contract cost for constructing structural measures. It includes all materials, labor, and machinery involved in construction (including mitigation measures). A contingency is added to the estimated contract cost for all works of improvement to defray any unexpected cost that may occur during construction. Also, a special 10 percent allowance was added to all main channel works to cover possible stability work during the establishment period.

Engineering costs are the costs for preparing construction plans for the structural measures. These costs include the direct cost of engineers, geologists, and technicians for construction surveys and investigations; soil and foundation drilling and testing; and design and preparation of construction plans and specifications.

Land rights costs include all expenditures for: 1) acquisition of land rights for construction and mitigation, the value of which is estimated by the sponsoring local organizations; 2) relocation or reconstruction of property line fences; 3) relocation alteration or removal of pipelines and/or utility lines; 4) all legal fees and surveys associated with acquisition of land rights. Land required for channel work includes a permanent easement on that land between the outside

EXPLANATION OF INSTALLATION COSTS

Structural measures - cont'd

edge of the buffer strip on the unconstructed side and the crest of the spoil bank on the constructed side. An area 15 feet from the ditch slope on the unconstructed side is required (when one side construction is used).

Project administration costs are the PL-566 and Other administration costs associated with the installation of the works of improvement. Project administration costs include the cost of contract administration which is borne by Other funds. Also included in project administration costs are government representative services and necessary inspection service during construction to insure that structural measures are installed in accordance with the construction plans and specifications. These latter expenses are paid by PL-566 funds.

Cost allocation and cost sharing

Costs for all planned channel improvement, surface drains and grassed waterways are allocated 50 percent flood prevention and 50 percent drainage. Costs for tile are allocated 100 percent drainage. Cost allocation procedures and methods are covered fully under ECONOMICS in the Investigations and Analyses section of this plan.

Cost sharing is as follows: PL-566 costs are 100 percent of construction and mitigation costs allocated to flood prevention and 50% to drainage. All engineering costs will be 100 percent PL-566 funds. All land rights costs will be paid by Other funds.

Project costs in Illinois

The work in the State of Illinois consists of lateral channel JC8. The structural measures planned for the Illinois portion of the watershed do not include tile installation.

A summary of the estimated installation costs in the State of Illinois follows:

	<u>PL-566</u>	<u>Pleasant Hill Drainage District</u>	<u>Total</u>
Construction	\$38,250	\$12,750	\$51,000
Engineering Services	5,100	--	5,100
Land Rights	--	16,280	16,280
Project Administration	10,200	1,530	11,730
TOTAL	<u>\$53,550</u>	<u>\$30,560</u>	<u>\$84,110</u>

EXPLANATION OF INSTALLATION COSTS

Structural measures - cont'd

Project costs in Indiana

All works of improvement in Reaches A, B, C, D, E, and J are located in Indiana. Certain surface drains and grassed waterways include associated tile main installations.

A summary of the estimated installation costs in Indiana are shown on the following table:

	<u>PL-566</u>	<u>Jordan Creek Conservancy District</u>	<u>Total</u>
Construction	\$798,880	\$302,920	\$1,101,800
Engineering Services	110,480	--	110,480
Land Rights	--	267,000	267,000
Project Administration	220,360	33,050	253,410
TOTAL	\$1,129,720	\$602,970	\$1,732,690

An estimated schedule of PL-566 and Other obligations for installation of the structural measures by fiscal year (without project administration cost) is tabulated in dollars as follows:

<u>FY</u> ^{1/}	<u>PL-566</u>		<u>Pleasant Hill Drainage District</u>	<u>Jordan Creek Conservancy District</u>
	<u>Illinois</u>	<u>Indiana</u>		
1st	\$25,000	\$ 25,240	\$20,000	\$ 16,620
2nd	18,350	358,630	9,030	222,010
3rd	--	328,600	--	198,850
4th	--	196,890	--	132,440
TOTAL	\$43,350	\$909,360	\$29,030	\$569,920

Non-project costs

There are no known or anticipated non-project costs for this project. Should any non-project costs occur, they must be borne by the sponsoring local organizations. This subject is covered here to avoid possible misunderstanding during contract negotiations and construction.

Non-project costs include all additional costs resulting from changes of, or additions to, project works of improvement for non-project purposes or maintenances such as 1) distributing and leveling spoil or disposing of excavated material primarily to improve land; 2) filling depressional areas outside of the right-of-way; or 3) modifying planned works of improvement for the convenience of the sponsoring local organization.

^{1/} The first 4 years of an 8 year installation period.

EFFECTS OF WORKS OF IMPROVEMENT

Conservation land treatment

The application of land treatment measures will bring an additional 35,567 acres under adequate treatment from a present condition of 13,794 to a future condition of 49,361 acres. Conservation practices to be applied to cropland are contour farming, grassed waterways, grade stabilization structures, conservation cropping systems, crop residue management, terraces, and minimum tillage. These practices will reduce erosion through interception of rainfall and reduction of runoff and stabilization of drainageways. Reducing sheet erosion will permit inherent and applied fertility to be maintained. The use of conservation cropping systems, including minimum tillage will provide improved plant growth through improvement of soil characteristics. The combined effects of these practices will reduce the annual soil loss of the 21,700 acres of erosive cropland from 3.9 tons/acre to 2.5 tons/acre. This rate of soil loss is within the 3.5 tons/acre annual soil loss tolerance. The application of soil and water conservation practices will reduce soil loss from erosion, promote the proper use of soil and water resources and provide lower maintenance costs for the planned structural measures.

These conservation practices will reduce the sediment yield from the Indiana portion of the watershed from an estimated 12,000 tons annually (.33 tons per acre) to about 9,000 tons annually (.21 tons per acre).

Removal of surplus water through installation of subsurface drains, drainage field ditches, and drainage mains or laterals will enhance growth on 50,000 acres of cropland with a wetness limitation. Reduced production costs, improved crop quality, and increased yields will increase the efficiency for the farm enterprise.

Pasture management practices to be applied on 185 acres will improve the overall quality and productivity of pasture areas. Soil erosion will be reduced from .22 tons/acre to .13 tons/acre. Such areas, when properly treated and managed, complement the overall farm operation, contributing significantly to farm income with a minimum of erosion.

Forest land treatment measures to be applied to 20 acres will improve the overall hydrologic condition of the watershed. Creation of good humus layer in these areas will reduce runoff and erosion. Approved cultural operations and livestock exclusion from forest land will improve the quality of future forest land production as well as increase the overall quality of production.

The average annual soil loss from the Indiana portion of the watershed will be reduced from an estimated 1.4 tons/acre to 0.8 tons/acre.

EFFECTS OF WORKS OF IMPROVEMENT

Conservation land treatment

Many species of wildlife will benefit from vegetative land treatment measures that contribute to the quality of wildlife habitat. Some of these measures are: grassed waterways, diversions, pasture and tree planting, critical area planting and protection from grazing.^{1/}

Some land use change is projected to occur during the life of this project; however, these changes are expected to result from changing economic and technological conditions rather than project action.

Structural measures

Greatest impact of planned channel improvement will be in relieving joint floodwater-drainage problems occurring throughout watershed Reaches A, B, C, D, E, F, and J. An estimated 16,800 acres in total will benefit from the project, 15,924 acres of which are in Indiana and 876 acres in Illinois, involving about 155 individual landowners.

Benefits will accrue through the removal of surplus surface and subsurface water. Many existing tile drains, currently inoperative because of poor outlet conditions, will become operational. Farming operations delayed in the past because of water problems will be permitted to proceed on a timely basis. Yields will increase and production costs decrease. Opportunities to capitalize on the production advantages afforded by an increasing level of technology will be increased.

In addition, many areas of the watershed affected by joint floodwater drainage problems, but not dependent on the project for their solution, will benefit through a demonstration effect. Structural measures installed as a part of the project will clearly serve as impetus to these areas for installation of the most practical combination of needed on-farm drainage improvements.

^{1/}Reference - Soil Conservation Service Biology Technical Note No. 6
Wildlife Response to Selected Conservation Practices

EFFECTS OF WORKS OF IMPROVEMENT

Structural measures - cont'd

Areas on which damage-reduction benefits were evaluated include the entire Indiana portion of the flood plain described under "Watershed Problems". Crop and pasture damages will be reduced by 40 percent, damage to roads and bridges 14 percent, and indirect damages 29 percent in these areas.

An estimated 155 agricultural landowners and several roads and bridges will be benefitted. Benefits will accrue through increased agricultural production, reduced crop and pasture production costs, and lower maintenance expenses on flood plain improvements. Principal beneficial effect will result from reduced stages on the more frequent floods (floods expected to occur once every five years or more often). A summary comparison of flooded areas with and without the project for the area on which damage-reduction benefits were evaluated in Indiana is presented below:

(Flood)	(Without Project)	(With Project)
100 year	1881	1774
5 year	1069	721
1 year	514	294

Protection from the one year cropping season flood will be afforded by the project on reaches A, B, C, D, and J.

No increase in stages will occur on the Illinois portion of Jordan Creek downstream of the area on which flood reduction benefits were evaluated. A summary of flooded areas with and without the project in Illinois is presented below:

(Flood)	(Without Project)	(With Project)
100 year	478	476
5 year	376	364
1 year	300	300

EFFECTS OF WORKS OF IMPROVEMENT

Structural measures - cont'd

The method of installation of structural measures is proposed so that the minimum possible wildlife habitat destruction will occur. About 22 acres of woody wildlife habitat will be destroyed during construction. The wildlife habitat losses will be mitigated by replanting trees and shrubs on the spoil area, securing a permanent easement on existing trees and shrubs as a "filter strip" on the unconstructed side of the channel. Based on recommendations of members of the fish and wildlife discipline, about 27 acres of trees and shrubs will be replanted in Indiana and one-third acre in Illinois. All disturbed areas within the permanent easement will be seeded with a grass and legume mixture to provide herbaceous cover for wildlife and to prevent erosion. The existing stream has some fishery value as a spawning stream up to the vicinity of Little Creek Tributary. This value will not be disturbed by the installation of the works.

The proposed design of structural measures and method of construction will reduce soil erosion within the channel, and provide for better bank stability. Sediment traps at selected intervals will reduce sediment movement downstream during construction activity.

Economic and social

During the period of construction, approximately 39 man-years of labor will be required for the installation. During the life of the project, about 8 man-years will be required annually for the operations and maintenance for structural and associated land treatment measures.

The quality of living for the beneficiaries of the project should be improved because of the benefits realized from the project. The average benefits for 155 farm units will be approximately \$3,280.

Secondary effects generated by the project will be through increased demands on local suppliers of goods and services and on local processing, transporting and marketing facilities.

PROJECT BENEFITS

Total average annual benefits to project structural measures are estimated at \$508, 757 (Table 6).

Primary benefits to structural measures were estimated as follows: damage reduction \$12,464, more intensive land use \$141,671 and drainage \$141,672 (Table 6).

Local secondary benefits to structural measures were estimated at \$212,950 (Table 6).

Only those secondary benefits generated by the project through increased demands on local suppliers of goods and services and on local processing, transporting and marketing facilities were evaluated. Benefits accruing through an enhancement of the overall environment of the watershed area, although significant locally, were not evaluated. Benefits of a secondary nature from a national viewpoint were not considered pertinent, and were therefore not evaluated.

COMPARISON OF BENEFITS AND COST

Average annual costs, benefits and comparison of benefits and costs are shown in tables 4 and 6. The ratio of average annual benefits, excluding secondary benefits, of \$295,807 to average annual cost of \$123,620 is 2.4:1.0. The ratio of benefits to costs is \$508,757 to \$123,620 or 4.1:1.0.

PROJECT INSTALLATION

Land treatment measures

The Warren and Vermilion County Soil and Water Conservation Districts will assume the responsibility for the application of the land treatment measures. The measures will be installed by private landowners and operators within an eight year period. The SCS will provide personnel to assist the district in providing landowners and operators technical assistance to develop conservation plans and to install planned practices. Technical assistance for the forest land measures will be furnished by the IDNR, Division of Forestry and the Illinois Department of Conservation in cooperation with the U.S. Forest Service.

Structural measures

All works of improvement in Indiana will be installed during a four year period, and in Illinois within a two year period. Construction plans and specifications on contracts will be completed after the land rights are secured. Mitigation measures are considered construction costs and will be a part of each construction contract. In order to make efficient use of personnel and to realize the most benefit from the structural measures, the works of improvement will be installed in the following yearly sequence by state:

INDIANA

1. Lateral Improvement - Reach J and Reach F
2. Jordan Creek Main - Reach E, Reach C and Reach B
Lateral Improvements - Reach C, Reach B and Reach F
3. Jordan Creek Main - Reach D
Lateral Improvement - Reach D
4. Little Creek Main - Reach A
Lateral Improvements - Reach A and Reach E

ILLINOIS

1. Jordan Creek Main - Reach F
Lateral Improvement - Reach F (Open Ditch)
2. Lateral Improvement - Reach F (Surface Drain)

PROJECT INSTALLATION

Structural measures - cont'd

The Jordan Creek Conservancy District is the sponsoring local organization qualified under state law to carry out works of improvement outlined in the Indiana portion of this plan. The Conservancy District has the powers of eminent domain and taxation, as provided by the Indiana Conservancy Act and will use these powers as necessary to assure scheduled completion of the project. The Conservancy District will be responsible for securing land rights and administering contracts for all works of improvement in Indiana. The Conservancy District will be responsible for 50 percent of construction costs allocated to drainage within Indiana.

The Pleasant Hill Drainage District is the sponsoring local organization qualified under Illinois law to carry out works of improvement outlined in the Illinois portion of this plan. The Drainage District has the power of eminent domain and assessment, and will use these powers as necessary to assure the scheduled completion of the project. The Drainage District will be responsible for securing land rights and administering contracts for all works of improvement in Illinois. The Drainage District will be responsible for 50 percent of construction costs allocated to drainage within Illinois.

The Soil Conservation Service, under authority of PL-566, will be responsible for all phases of installation of works of improvement, including engineering services, except for acquisition of land rights and contracting for construction. The Service will be responsible for all construction costs allocated to flood prevention and 50 percent of construction costs allocated to drainage.

The Indiana Department of Natural Resources, in accordance with state laws and regulations, will review and approve plans and specifications for structural works of improvement to be constructed in Indiana.

The Jordan Creek Conservancy District will administer contracts for structural measures in Reaches A, B, C, D, E and J. The Pleasant Hill Drainage District will administer contracts for structural measures in Reach F. In addition, they will each be accountable for managing finances associated with installing those measures which involve the expenditure of PL-566 funds. This will require development of a financial management system which shall provide for the maintenance of appropriate records, reports, audits and accounts needed to satisfy the requirements of OMB Circular A-102.

PROJECT INSTALLATION

Structural measures - cont'd

An interdisciplinary team comprised of representatives from the Indiana Department of Natural Resources, Illinois Department of Conservation, U.S. Fish and Wildlife Service, landowners and sponsors, and the SCS will participate in the development of design plans and specifications and operation and maintenance procedures. These cooperatively developed plans and specifications will be adhered to unless determined inappropriate during construction; however, all members of the team will be provided the opportunity to develop the necessary revisions.

FINANCING PROJECT INSTALLATION

Federal financial assistance for carrying out the works of improvement set forth in this plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (PL-566, 83rd Congress, 68 Stat. 666) as amended. Federal financial assistance is contingent on the appropriation of funds to carry out this plan.

Land treatment measures

Technical assistance for installation of all accelerated land treatment for which the Soil Conservation Service has responsibility, will be provided with PL-566 funds. Technical assistance for forest land treatment measures will be provided by the IDNR, Division of Forestry and the Illinois Department of Conservation, Division of Forestry in cooperation with the U.S. Forest Service through the Cooperative Forest Management Program.

Any cost-sharing for installation of approved land treatment measures will be provided through the Rural Environmental Conservation Program (RECP), administered by the Agricultural Stabilization and Conservation Service, or by other funds as might be appropriated by Congress.

Structural measures

The Jordan Creek Conservancy District in Indiana has been organized since 1969. They have levied a general tax over the watershed within the state during the interim planning period.

They have carried out their necessary organizational activities during this period. In consideration of their financial needs during operations, they have filed a letter of intent with the Farmers Home Administration for a FHA loan.

The Pleasant Hill Drainage District in Illinois has been in existence since about 1900. They will make assessments on the land-owners for the local share of project costs that occur within their district boundaries.

Both sponsors have engaged legal counsel and are prepared to act as the contracting organization in their respective state and district.

The Jordan Creek Conservancy District is responsible for the following installation costs:

1. 100 percent of the land rights est. \$267,000;
2. 50 percent of tile and 75 percent of all other construction costs est. \$302,920;
3. Project administration costs est. \$33,050.

The Pleasant Hill Drainage District is responsible for the following installation costs:

1. 100 percent of the land rights est. \$16,280.

FINANCING PROJECT INSTALLATION

Structural measures - cont'd

2. 25 percent of the construction costs est. \$12,750;
3. Project administration costs est. \$1,530.

Invitations to bid on the construction of planned structural measures will be issued after the project agreements are executed. These agreements will be administered when the following conditions have been met: 1) PL-566 funds have been appropriated; 2) the appropriate sponsor has funds available and is prepared to fulfill its responsibilities; 3) necessary land rights for construction and mitigation have been obtained; 4) construction plans and specifications have been prepared and approved as required; and 5) operation and maintenance agreements and plans have been executed.

In accordance with OMB Circular A-102, the Jordan Creek Conservancy District and the Pleasant Hill Drainage District will account to the Service certain earned income during the grant period.

For this purpose, the grant period shall extend from the effective date of the Service's fund obligating agreement until the date on which the Service formally notifies the sponsors that the undertaking has been satisfactorily completed.

Program income may include, but not be limited to, income from service fees, usage, or rental fees and sale of assets purchased with federal funds under a Service-fund agreement.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures

The land treatment measures in Indiana will be operated and maintained by the owners and operators of farms under agreement with the Warren County Soil and Water Conservation District. The land treatment in Illinois will be operated and maintained by the owners and operators of farms under agreement with the Vermilion County Soil and Water Conservation District. Technical assistance will be provided by the Soil Conservation Service.

Forest land treatment measures will be maintained by the landowners with technical assistance furnished by Indiana Department of Natural Resources or Illinois Department of Conservation in cooperation with the U.S. Forest Service under the going Cooperative Forestry Program.

Structural measures

Operation and maintenance costs include all necessary expenditures after installation to realize the estimated benefits during the project evaluation period.

The sponsoring local organizations will assume responsibility for operation and maintenance of all measures including measures for fish and wildlife. The operation and maintenance work will consist of such items as spraying or controlling of adverse vegetative growth within the channel and on channel side slopes, removing debris and/or excavation of shoal deposits as required to reduce serious bank erosion, maintaining channel capacity, repairing of critical areas by seeding, sodding or placement of riprap, and protection of project mitigation features within the permanent easement areas. Operating agreements will include provisions as indicated in the revegetation plan. Operation and maintenance activities will be conducted in a manner to minimize adverse environmental effects. State and federal agency restrictions on pesticides will be recognized when providing maintenance on project rights-of-way.

The Jordan Creek Conservancy District will be responsible for the operation and maintenance of the structural works of improvement installed within the State of Indiana. The Pleasant Hill Drainage District will be responsible for the operation and maintenance of the works of improvement installed within Illinois. They have the authority to finance this work by either taxation or special assessment. They shall budget annually the necessary funds to meet the probable expenses of operation and maintenance plus 10 percent to meet contingencies.

Annual operation and maintenance cost for Indiana's works of improvement is estimated to be \$15,850. Operation and maintenance cost for Illinois' works of improvement is estimated to be \$680 annually.

PROVISIONS FOR OPERATION AND MAINTENANCE

Structural measures - cont'd

A period of time is prescribed to provide for the establishment of adequate vegetative cover for channels. This "establishment period" shall extend for up to three years from the date the structural works of improvement are accepted from the contractor as being completed. The establishment period is to terminate when any of the following conditions are met:

- a. Adequate vegetative cover is obtained:
- b. Two growing seasons have elapsed after the initial installation of vegetative work:
- c. Three years after completion of works of improvement.

The Soil Conservation Service and the local sponsors have agreed to accept some minor deviation in the design criteria of some channels recognizing a degree of risk is involved in establishing their stability. Additional work may be necessary during the establishment period to achieve the desired stability.

During the establishment period for vegetative measures, SCS may approve PL-566 cost-sharing for additional work required to obtain an adequate vegetative cover. Approval of SCS is also required for PL-566 cost-sharing for other repair or additional work on completed structural works of improvement. Requests for approval will be considered if:

- a. The need is determined during the establishment period:
- b. The need results from latent conditions unknown to both SCS and the sponsor:
- c. PL-566 cost-sharing requested for the repair of additional work does not exceed the ratio authorized for the original construction of the specific work involved;
- d. Performance of the repair or additional work does not lessen or adversely affect the legal liability of the construction contractor or his surety to bear the cost of the work.

A Soil Conservation Service representative will make a joint inspection with the sponsors annually, after severe floods, and after the occurrence of any unusual conditions that might adversely affect the structural measures. These joint inspections will continue for three years following the acceptance of the works of improvement for operation and maintenance by the local sponsors. Inspections after the third year will be made annually by the sponsors. A report will be prepared of any such inspections making sure that the Service representative receives a copy. The Indiana Department of Natural Resources or the Illinois Division of Waterways, as appropriate, will be informed of any scheduled inspections within each respective state. A record of each inspection will be kept in the sponsor's file and will be available for authorized inspection.

PROVISIONS FOR OPERATION AND MAINTENANCE

Structural measures - cont'd

Specific operation and maintenance agreements and plan will be executed between the sponsors and the Soil Conservation Service prior to signing land rights, relocation or project agreement. These agreements will use as a basis the SCS State Watershed Operations and Maintenance Handbook. These agreements will contain, in addition to specific sponsor responsibilities for non-structural and structural measures, specific provisions of OMB Circular A-102 for retention and disposal of real and personal property acquired in whole or in part with PL-566 funds.

TABLE 1 - ESTIMATED PROJECT INSTALLATION

Jordan Creek Watershed, Indiana-Illinois

INSTALLATION COST ITEM	Unit	Number		Estimated Cost (Dollars)1/								Total		
				Pl-566 Funds Non Federal Land		Other								
						Non Federal Land		SCS 4/						
								Ind.		Ill.			FS 4/	
										Ill.			Ill.	
Ac.	Ind.	Non-Fed. Land Ill.	Total	Ind. & Ill.	Ind.	Ill.	Ind.	Ill.	Ind.	Ill.	Total			
LAND TREATMENT														
Land Areas 2/														
Cropland	Ac.	27,347	8,000	35,347				679,320	145,850			825,170		
Grassland	Ac.	150	35	185				7,800	4,050	470	280	11,850		
Forest Land	Ac.	15	5	20								750		
Other Land	Ac.	5	10	15				6,250	500			6,750		
Technical Assistance						18,640		41,600	8,230	200	500	69,170		
TOTAL LAND TREATMENT		27,517	8,050	35,567		18,640		734,970	158,630	670	780	913,690		
STRUCTURAL MEASURES														
Construction														
Channel Modification3/														
(M)	Mi.	22.3	-0-	22.3		582,420		194,200				776,620		
(O)	Mi.	4.6	0.6	5.2		60,360		9,000	11,120			80,480		
Surface Drains and Grassed														
Waterways	Mi.	51.8	1.9	53.7		139,500		44,870	1,630			186,000		
SP Main Tile Installation	Mi.	19.8		19.8		54,850		54,850				109,700		
Subtotal - Construction						837,130		302,920	12,750			1,152,800		
Engineering Services														
Subtotal - Engineering						115,580						115,580		
Project Administration														
Construction Inspection														
Other Cost						92,220		33,050	1,530			92,220		
Subtotal - Project Adm.						138,340		33,050	1,530			172,920		
Other Costs						230,560		33,050	1,530			265,140		
Land Rights														
Su Subtotal - Other								267,000	16,280			283,280		
								267,000	16,280			283,280		
TOTAL STRUCTURAL MEASURES						1,183,270		602,970	30,560			1,816,800		
TOTAL PROJECT						1,201,910		1,338,410	189,470	200	500	2,730,490		

1/ Price Base: 1974

2/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts applied to total land areas, not just to adequately treated areas.

3/ Type of channel prior to project: (M) - manmade ditch or previously modified channel; (O) - none or practically no defined channel.

4/ Federal agency responsible for assisting in installation of works of improvement.

TABLE 1A - STATUS OF WATERSEHD WORKS OF IMPROVEMENT

(At time of Work Plan Preparation)

Jordan Creek Watershed
Indiana-Illinois

Measures	Unit	Applied to Date		Total Cost (Dollars ^{1/})	
		Indiana	Illinois	Indiana	Illinois
<u>Land Treatment</u>					
Basic Conservation Plans	No.	58	60	-	-
Conservation Cropping System	Ac.	10,130	6,350	50,650	31,750
Contour Farming	Ac.	398	1,090	1,194	3,270
Critical Area Planting	Ac.	-	24	-	12,000
Crop Residue Use	Ac.	7,250	5,690	21,750	17,070
District Cooperators	No.	123	102	-	-
Drainage Field Ditch	Ft.	5,000	9,730	3,500	6,811
Drainage Main or Lateral	Ft.	4,000	1,200	6,000	1,800
Grade Stabil. Structure	No.	21	13	25,200	15,600
Grassed Waterway or Outlet	Ac.	30	45	12,000	18,000
Minimum Tillage	Ac.	8,500	4,020	25,500	12,060
Pasture and Hayland Mgt.	Ac.	260	70	7,800	2,100
Pasture and Hayland Planting	Ac.	-	490	-	17,150
Pond	No.	-	2	-	2,000
Standard Soil Survey	Ac.	25,000	15,000	6,500	3,900
Subsurface Drain	Ft.	2,030,000	200,000	1,624,000	160,000
Tree Planting	Ac.	10	15	350	525
Wildlife Upland Habitat Mgt.	Ac.	35	14	1,750	700
Subtotal	XXX	XXXXXXXXXX	XXXXXXX	1,786,194	304,736
TOTAL	XXX	XXXXXXXXXX	XXXXXXX	2,090,930	

^{1/} Price Base: 1974

November 1974

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Jordan Creek Watershed, Indiana-Illinois
(Dollars)^{1/}

Item ^{2/}	Installation Cost PL-566 Funds			Installation Cost - Other Funds			Total Installation Cost
	Construction ^{3/}	Engineering	Total PL-566	Construction ^{2/4/}	Land Rights	Total Other	
Reach A - Leak Ditch Lat. Improvements	53,620 48,250	7,150 6,730	60,770 54,980	17,880 19,050	12,800 19,590	30,680 38,640	91,450 93,620
Reach B - Main Lat. Improvements	57,520 144,870	7,670 19,950	65,190 164,820	19,180 54,630	14,050 56,980	33,230 111,610	98,420 276,430
Reach C - Main Lat. Improvements	47,620 63,970	6,350 8,680	53,970 72,650	15,880 22,830	14,830 23,030	30,710 45,860	84,680 118,510
Reach D - Little Creek Lat. Improvements	110,470 178,020	14,730 25,380	125,200 203,400	36,830 75,780	27,000 59,240	63,830 135,020	189,030 338,420
Reach E - Main Lat. Improvements (Ind.)	1,500 70,770	500 10,370	2,000 81,140	500 32,930	100 30,190	600 63,120	2,600 144,260
Reach F - Main Lat. Improvements	38,250	5,100	43,350	12,750	16,280	29,030	72,380
Reach J - Lat. Improvements	22,270	2,970	25,240	7,430	9,190	16,620	41,860
Subtotal	837,130	115,580	952,710	315,670	283,280	598,950	1,551,660
Project Administration	XXXXXX	XXXXXX	230,560	XXXXXX	XXXXXX	34,580	265,140
GRAND TOTAL	XXXXXX	XXXXXX	1,183,270	XXXXXX	XXXXXX	633,530	1,816,800

^{1/} Price Base: 1974^{2/} See Table 3A for type of channel that existed before the project^{3/} Mitigation costs for construction to PL-566 \$15,070 and to other \$5,030 (\$4,930 Ind. and \$100 Ill.)^{4/} All lateral improvement construction costs include 50% of tile cost where applicable

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Jordan Creek Watershed, Indiana-Illinois
(Dollars) 1/

Item	COST ALLOCATION				COST SHARING				
	Purpose				PL-566				Other
	Flood Prevention	Drainage	Total		Flood Prevention	Drainage	Total	Flood Prevention	Drainage
Reach A-Leak Ditch Lat. Im.	45,720 41,910	45,730 51,710	91,450 93,620		39,320 32,120	21,450 22,860	60,770 54,980	6,400 9,790	24,280 28,850
Reach B-Main Lat. Imp.	49,210 127,760	49,210 148,670	98,420 276,430		42,180 99,270	23,010 65,550	65,190 164,820	7,030 28,490	26,200 83,120
Reach C-Main Lat. Imp.	42,340 56,780	42,340 61,730	84,680 118,510		34,920 45,260	19,050 27,390	53,970 72,650	7,420 11,520	23,290 34,340
Reach D-Little Crk. Lat. Imp.	94,510 142,090	94,520 196,330	189,030 338,420		81,010 112,470	44,190 90,930	125,200 203,400	13,500 29,620	50,330 105,400
Reach E-Main Lat. Imp.	1,300 56,730	1,300 87,530	2,600 144,260		1,250 41,630	750 39,510	2,000 81,140	50 15,100	550 48,020
Reach F - Lat. Imp.	36,190	36,190	72,380		28,050	15,300	43,350	8,140	20,890
Reach J - Lat. Imp.	20,930	20,930	41,860		16,330	8,910	25,240	4,600	12,020
GRAND TOTAL	715,470	836,190	1,551,660		573,810	378,900	952,710	141,660	457,290

1/ Price Base: Same as Table 2

November 1974

TABLE 3 - STRUCTURE DATA
(Main Channels)

Jordan Creek Watershed, Indiana-Illinois

Channel Name and Reach	Station	Drainage Area Sq. Mi.	Required Capacity cfs.	Channel Dimensions ^{1/}			"n" Value		Velocities		Excava- tion Cu.-Yds.	Pur- pose	Before Project	
				Width	Bottom Grade	Depth ^{2/} of Flow	Aged	As Built	Aged	As Built			Type of Channel ^{4/}	Flow Condition ^{5/}
Jordan Creek Reach B	101+00	5.5	160	4	.0021	4.0	.040	.028	2.9	3.7	13,000	MP	M	I
	235+00 410+86	16.0	400		NO	WORK								
Jordan Creek Reach C	410+86	28.0	640	20	.00074	5.7	.030	.025	3.3	3.8	14,000	MP	M	I
	508+00 578+08	28.4			NO	WORK								
Jordan Creek Reach E	578+08 668+00	51.0	1050	DEBRIS	REMOVAL						-0-	MP	M	I
Leak Ditch Reach A	8+00	1.5	55	4	.0044	2.1	.040	.028	2.9	3.7		MP	M	I
	35+70	2.6	86	4	.0021	3.0	.040	.028	2.4	3.2		MP	M	I
	65+00	4.3	130		NO	WORK								
	170+12 226+22 226+22 285+00	7.1 7.1	200 200	8	.0007	4.6	.035	.028	2.2	2.6	12,000	MP	M	I
Little Creek Reach D	23+60	5.6	160	4	.00066	5.1	.040	.028	1.9	2.4		MP	M	I
	125+90	10.0	270	6	.00066	5.3	.040	.028	2.1	2.8		MP	M	I
	225+00 323+24 323+24 358+00	15.0 16.3	375 410	10	.0007	5.9	.035	.028	2.6	3.0	30,000	MP	M	I

1/ Side slopes on constructed side are 3:1 and on unconstructed side are approximately 2:1.

2/ Depths shown are normal depths for the capacity required.

3/ Purpose: MP-Multiple Purpose

4/ (M)-Marmade ditch or previously modified channel.

5/ I-Intermittent - continuous flow through some seasons of the year but little or no flow through other seasons.
Pr-Perennial - flows at all times except during extreme drought.

TABLE 3 - STRUCTURE DATA - (CONT'D)
(LATERAL IMPROVEMENTS)

Jordan Creek Watershed, Indiana-Illinois

Reach	Open Drain Mi. <u>1/</u>	Surface Drain Ft. <u>2/</u>	Grass Waterway Ft. <u>3/</u>	Tile Ft. <u>4/</u>	
<u>A</u> LD (LD-3A-8A) <u>5/</u> LD-1 (LD-1A) LD-2 (LD-2A) LD-3	.2 .5 .2	17,100 12,000 3,800	2,300 1,200	6,500 2,400	<u>1/</u> Open drains with minimum specifications of B. W. - 4', Depth-5' and S.S. - 3:1
<u>B</u> JC (JC-13A-20A) JC-3 (JC-3A-3C) JC-4 (JC-4A-4E) JC-5 (JC-5A)	2.2 2.1 .8	24,400 17,900 27,300 5,800	3,700	8,900 4,300 6,800	<u>2/</u> The term "surface drain" is an accepted local term which includes drainage mains or laterals and open channels.
<u>C</u> JC (JC-10-12A) JC-2 (JC-2A-2C)	2.3	8,700 7,300	2,700	1,000 3,600	<u>3/</u> Grass Waterways: Same specifications as <u>2/</u>
<u>D</u> LC (LC-4A-14A) LC-1 (LC-1A-1C) LC-2 (LC-2A-2E)	1.2 2.8	59,000 7,200 20,200	300	38,600 1,600 4,500	<u>4/</u> Tile mains to be installed in conjunction with surface drains and grass waterways.
<u>E</u> JC (JC-6A-9A) JC-1 (JC-1A-1C)	0.3 1.0	20,200 13,300	9,900 6,700	16,800 9,400	<u>5/</u> Location designation (See Project Map)
<u>F</u> JC-8	.6	10,000			
<u>J</u> MF-1	1.1	2,300			

TABLE 3A - INVENTORY OF CHANNEL WORK

Jordan Creek Watershed, Indiana-Illinois

Reach	Main Miles	Type of Work	Type of Channel	Flow Condition Before Project
A - Leak Ditch	2.1	II	M (1890)	I
Lat. Improvements	.4	II	M (1890)	E
	.5	I	O	E
B - Main	2.5	II	M (1890)	Pr
Lat. Improvements	4.8	II	M (1905)	E
	.3	I	O	E
C - Main	1.9	II	M (1905)	Pr
Lat. Improvements	1.1	II	M (1905)	E
	1.2	I	O	E
D - Little Creek	5.7	II	M (1915)	I
Lat. Improvements	2.6	II	M (1920)	E
	1.4	I	O	E
E - Lat. Improvements	1.0	II	M (1950)	E
	0.3	I	O	E
F - Lat. Improvements	.6	I	O	E
J.- Lat. Improvements	.2	II	M (1920)	E
	.9	I	O	E
Total Miles in Each Code Classification	27.5	I - 5.2 II-22.3	M-22.3 O- 5.2	Pr- 4.4 I - 7.8 E -15.3

Legend:

- I - establishment of new channel including necessary stabiliztion measures.
- II - enlargement of existing channel or stream.
- M()- manmade ditch or previously modified channel.
- O - none or practically no defined channel
- Pr - perennial--flows at all times except during extreme drought.
- I - intermittent--continuous flow through some seasons of the year but little or no flow through other seasons.
- E - ephemeral--flows only during periods of surface runoff.

November 1974

TABLE 4 - ANNUAL COST

Jordan Creek Watershed, Indiana-Illinois
(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost <u>2/</u>	Operation and Maintenance Cost	Total
Reaches A-F	88,990	16,350	105,340
Reach J	2,470	180	2,650
Project Administration	15,630	XXXXXXXX XXXXXXXX	15,630
GRAND TOTAL	107,090	16,530	123,620

1/ Price Base: Installation same as table 2.

2/ 100 years @ 5 7/8 percent interest.

November 1974

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Jordan Creek Watershed, Indiana-Illinois

(Dollars) 1/

Item	<u>Estimated Average Annual Damage</u>		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Crop and Pasture	28,011	16,917	11,094
Road and Bridges	4,775	4,095	680
Subtotal	32,786	21,012	11,774
Indirect	2,355	1,665	690
TOTAL	35,141	22,677	12,464

1/ Price Base: Agriculture prices 1973 current normalized (WRC-Feb. 1974).
Other items current 1974.

November 1974

Jordan Creek Watershed, Indiana-Illinois

Average Annual Benefits 1/

1/ Price Base: Agriculture prices 1973 current normalized (WRC-Feb. 1974). Other items current 1974.

November 1974

INVESTIGATIONS AND ANALYSES

This section describes the type and intensity of the investigations and analyses which were made in formulating and evaluating the project. It describes the scope and intensity of surveys and investigations and the methods used in analyzing and interpreting the basic watershed data in order to determine the physical and economic feasibility of the project. The material is presented under the following appropriate headings.

LAND USE AND TREATMENT

The basic data for watershed land use and treatment was prepared by the sponsors with assistance from the local Soil Conservation Service and the Indiana Department of Natural Resources personnel. Information was obtained from the Conservation Needs Inventory, conservation plans, soil surveys, and local leaders familiar with the watershed.

Procedure used in developing the data began with a listing of predominant watershed soils by capability class, sub-class and treatment unit. Soils having similar use capabilities, treatment needs, and hydrologic characteristics were combined into soil groups. Present and anticipated future use and treatment of soils within each grouping was then determined.

Once finalized, the land treatment data provided the basis for estimations of "with" and "without project" rainfall runoff in the watershed. In so doing, an analytical framework was established within which watershed problems and effects of treatment could be studied.

FISH AND WILDLIFE

Some biology field studies have been made in or near this watershed. The rural letter carrier game surveys, spring growing counts, and sportsman questionnaires have been utilized in this study. The game census and fishery survey information has been supplied by the IDNR Division of Fish and Wildlife.

Onsite observations by field biologists* indicated the proposed structural measures will be compatible with existing fish and wildlife resources within the watershed area providing current criteria is used. This criteria includes, but is not limited to, such things as sediment traps, vegetative filter strips, one-side construction, replanting of woody cover, life of project easements with permanent markers and/or fence as needed, and other coordinated efforts in planting, design, construction, operation and maintenance.

Several multi-agency biology field reviews have been conducted. Early reviews were concentrated on those areas identified in the original

*Official views of the Fish and Wildlife Service on the proposed project are only provided by the Regional Director or his representative.

FISH AND WILDLIFE - CONT'D

work plan. A field review was conducted on the current planned project in November 1974 by representatives of the IDNR, Division of Fish and Wildlife, the U.S. Fish and Wildlife Service, Extension Service, and the Soil Conservation Service.

HYDRAULICS AND HYDROLOGY

The watershed was analyzed using procedures outlined in the National Engineers Handbook, Section 4, HYDROLOGY. This analysis was used to help design the structural works of improvement and for the economic evaluation.

Resource material

Basic data used for these studies were engineering field surveys, USGS topographic maps and water supply papers, aerial photographs and other available material.

Field surveys were completed on 21 valley sections, 35 channel sections and 27 bridges in Illinois, and 9 valley sections, 35 channel sections and 28 bridges in Indiana. Low area elevations were obtained at additional locations. These surveys were used for the draft work plan of 1972. Additional surveys were completed in the spring of 1974 consisting of 13 valley sections, 12 channel sections, 2 bridges and 7 road profiles. These surveys were all in Indiana beginning at the state line and proceeding upstream to Tab, Indiana, on Jordan Creek and up Little Jordan Creek to the bridge east of Stewart.

Land use and treatment considerations

The runoff curve numbers were provided by the land treatment specialist with assistance from the district conservationists of the Warren County Soil and Water Conservation District in Indiana and the Vermilion County Soil Conservation District in Illinois. The runoff curve number for the without project condition is 79, for the land treatment only project the runoff curve number provided is 77, and for land treatment plus the works of improvement including the water management practices the runoff curve number provided is 75. In Illinois, with the land treatment only, the runoff curve number is 77. The runoff curve number provided for the without project checks rather closely with the stream gage located on the Vermilion River at Danville, Illinois.

These runoff curve numbers were considered as antecedent moisture condition II and on the all-year basis.

Time of concentration

The hydrologic factor, T_c , was calculated by the velocity-travel-length method. The without project T_c 's were updated from the draft

HYDRAULICS AND HYDROLOGY

Time of concentration - cont'd

work plan of 1972 because of the additional surveys and new data. The with project Tc's were recalculated taking into consideration the water management practices.

Frequency analysis

Weather Bureau Technical Paper No. 40 rainfall depths by frequency for the 24-hour, all-year, partial duration storms, were plotted on semi-log paper.

Jordan Creek Watershed has no rain or stream gages located within its boundary. Therefore, studies were made of Weather Bureau rain gages and USGS stream gages in the vicinity of Jordan Creek. The hourly rain gages were located at Fowler, Collegeville, Chalmers, and Attica, Indiana, and at Hoopeston and Danville, Illinois. The daily rain gages used were located in Indiana at the following towns: Covington, Crawfordsville, Frankfort, and Lafayette. These gages were used to develop the composite mass rainfall curves. The stream gages studied were located on Carpenter Creek, Big Sugar Creek, Big Pine Creek located in Indiana, and the Vermilion River which serves as an outlet for Jordan Creek at Danville, Illinois. These stream gages were chosen for studies because their respective watersheds have predominantly the same topography, soils, and cropping systems as does Jordan Creek Watershed.

The storms that produced the peak annual series floods within the partial duration flood flows at the Vermilion River stream gage occurred at different seasons over the years, and the soils at one time or another were in all the antecedent moisture conditions I through III. The duration of these storms that produced the floods were from 1 day through 7 days with rainfalls from 0.9 of an inch to over 7 inches, which in turn produced runoffs of 0.4 of an inch to over 4 inches. These runoffs, when arranged and plotted on semi-log paper and compared to TP40's 24-hour storm duration by frequency, calculated out to be RCN79.

Hydraulic studies

Twelve water surface profiles were run at Indiana University facilities for the without project condition and the with project condition using the Water Surface Profile Program Number 2. Full utilization of this program was made for the development of the channel design for this plan.

Flood routing

The flood routings were made using TR-20 procedures with the standard dimensionless hydrograph ($K=484$), using the facilities at

HYDRAULICS AND HYDROLOGY

Flood routing - cont'd

Indiana University for the without project condition, and the trial flood routings for project development. A complete array of storms were routed and they are as follows:

<u>Frequency Percent Chance</u>	<u>(24-hour) Rainfall (in.)</u>	<u>Runoff (in.) Without Project RCN 79</u>	<u>Runoff (in.) With Project RCN 75</u>
1	6.0	3.67	3.28
2	5.5	3.23	2.86
4	4.9	2.71	2.37
10	4.3	2.21	1.89
20	3.8	1.80	1.52
50	2.95	1.15	.93
100	2.6	.90	.71
200	2.0	.52	.38

Hydrologic effects

The flood routed peak discharges, q , were plotted versus volume of runoff in inches, Q . Likewise, water surface elevations were plotted versus volume of runoff in inches. These graphs were made for each evaluation section within the project area. Using the runoff depth by percent chance data developed in the frequency analysis, it was possible to read peak-frequency and elevation-frequency information from these charts. These data were also placed on spread sheets for each evaluation reach. Area flooded curves were developed and provided to the economist using the valley sections located in each evaluation reach. Discharge curves by frequency in cubic feet per second versus drainage area were developed and furnished to the engineer for channel design purposes.

ENGINEERING

Design of structural measures

The basic data used for channel designs and cost estimates were field surveys, USGS topographic maps, aerial photographs, geological investigations and field observations. Profiles were prepared from numerous cross sections, valley sections, and bridge surveys and were used to determine bank full elevations, grades, and hydraulic gradients of the channels. Capacities used were based on discharges provided by the planning hydrologist.

Engineering studies leading to final structural formulation involved consideration of four alternate designs of channel improvements. No feasible flood detention structure sites were found for consideration. The first three alternate designs were for progressively decreasing capacity in main stream channels. The capacities approximated the discharges required by the B and C drainage curves of SCS National Engineering Handbook, Section 16. Results of flood routing the watershed with these designs were analyzed so that the design necessary to provide the required 1-year cropping season protection could be defined.

Construction of the channel will be done from one side only using a 3:1 side slope. The side will be chosen during the final design phase. Factors to be used in making this decision will be bank stability, quality of wildlife habitat, thermal pollution, and maintenance access. Bridge approaches will be constructed from both sides. Clearing will be minimized and will include only the area within the channel banks and area necessary for construction and spoil disposal.

An "aged" and "as built" analysis of the channel design was made in accordance with current Service criteria. The allowable velocity and tractive force methods were used to analyze the soils encountered. Some minor deviation in the "as built" criteria was accepted recognizing a degree of risk is involved in establishing the initial stability. Additional work may be necessary during the establishment period to achieve the desired stability of the channels. This should be accomplished at a cost not exceeding 10 percent of the construction cost. The only major stability problem was in the upper portion of Reach A. Minor problems exist in Reaches B and F. Protection was accomplished by using armor plating on the channel bottom and sides where needed. Approximately 3,170 cu. yds. of material was used for protection. The associated costs are incorporated in the project cost.

The debris removal in Reach E consists of the removal of a small log jam near station 595+00 and very minor debris removal (logs) throughout the remainder of the reach. Total estimated cost--\$2,000. The scope of the work is such that the stability will not be affected.

ENGINEERING

Land rights for structural measures

Area needed and costs for permanent land rights for open channels were based on that area within the ditch banks, plus overbank lands out 15 feet on the unconstructed side, plus a 12-foot berm and the spoil bank to the crest on the constructed side. Permanent land rights boundaries are to be marked in the field, or fenced where adjacent lands are pastured, to protect the channel and mitigation areas.

The area to be placed in grassed waterways required permanent land rights and was figured to cost the value of the land. Access right-of-way to assure perpetual entry for maintenance is a part of the land rights costs for all structural measures.

Temporary land rights costs were figured to include the area outside permanent easements needed during construction, on which to maneuver equipment and spoil excavated material, when necessary. These will include open channels, surface drains, and grassed waterways.

No land rights costs were considered necessary for subsurface drains installed as a structural measure. This attitude was taken in view that no additional lands were involved beyond those for which land rights would be obtained for either surface drains or grassed waterways.

Cost estimates for structural measures

Yardage estimates were made by the average end area method. The channel construction and mitigation cost estimates were based upon unit prices determined from abstracts of bids on the most recent PL-566 contracts in Indiana. Values for land rights were estimated by the local sponsors.

The annual operation and maintenance costs were figured using record data on completed practices and anticipated costs for each type of improvement.

Supporting data available to design and construction engineers and regulatory agencies show detailed cost analyses.

GEOLOGY

The geologic investigation included a review of published surficial and bedrock geologic maps, soil survey reports, aerial photos, and geologic literature, as well as field investigations.

Erosion and sedimentation

Gross sheet erosion rates were calculated using the Universal Soil Loss Equation. Stream, gully, and other erosion rates were calculated as a percentage of the sheet erosion figures. Delivery ratios were modified using available SCS publications. Soils, land use, and land treatment data were supplied by the district and area conservationists of the SCS.

Field investigations indicated that sediment and erosion damages were not severe enough to warrant a detailed economic and physical evaluation.

Channels

Preliminary channel investigations consisted of selected earth borings utilizing a hand-auger and hydraulic soil probe. Selected samples were submitted to the Soil Conservation Service Soil Mechanics Laboratory for classification and routine index tests. Based upon the results of this preliminary study, additional earth borings were made using both a hand-auger and power-assisted rotary drill rig. Additional soil samples were collected and analyzed. The results of the investigation and sample analyses were submitted to and discussed with the planning engineer as considerations for channel design.

The black surface soils in the upstream reaches are underlain by glacial till composed of silty and sandy clays with low to moderate plasticity. Most of the upstream channels have been reconstructed in the past with about 1.5 to 1.0 side slopes. The vegetated banks are stable.

The middle to lower main channel reaches contain materials similar to the upper reaches, but also have discontinuous sand and gravel lenses. The lenses have no apparent pattern of occurrence and are not continuous along the channel. The glacial till in these reaches is moderately plastic with some low plasticity material close to the surface. The channel banks are eroding on the outside of some stream meanders.

ECONOMICS

Identification of watershed problems and consideration of effects of proposed improvements provided the basis for evaluation of project benefits. Basic datum was obtained through interviews with watershed residents, Soil Conservation Service employees, and local watershed leaders. Field economic studies and information supplied by other watershed planning specialists supplemented basic interview data. Analysis of all project benefits was made through a comparison of future "with" and "without project" conditions. Information utilized and results obtained were reviewed for reasonableness and accuracy.

Floodwater damage

Floodwater damages were evaluated using the "frequency method" as described in Chapter 3 of the Economics Guide. Identification of the relationship between flood size and resulting flood damages provided the basis for damage determination under this method.

Crop and pasture

Evaluation of crop and pasture flood damages under the "frequency method" was achieved utilizing standardized crop depth-damage factors as a base. Factors used had been previously developed for evaluation of watershed projects throughout the northern portion of Indiana. Such factors relate flood depth and month of flood occurrence to expected crop losses expressed as a percentage of gross income. Sufficient interview information was obtained to support applicability of the factors for use in the watershed.

Composite acre, flood depth-damage factors were then developed. Incorporated into these factors were the above-mentioned crop damage factors plus data on future flood plain land use, projected crop yields and prices, and monthly cropping season probabilities of flood occurrence. Resultant composite acre values served as estimated of expected losses on a representative flood plain acre from various depths of flooding irrespective of the month of flood occurrence.

Application of the composite acre factors to acre-frequency information supplied by the planning hydrologist provided the means of determining damage-frequency relationships and subsequently average annual damages with and without project. Such damages were adjusted to eliminate double counting arising through recurrent flooding in a given year. Basis for the adjustment was regression analysis of the ratio Y (average annual damages adjusted for recurrent flooding/unadjusted average annual damages) on the ratio R (average annual acres flooded/maximum flood plain acres).

Floodwater damages on a total of 1,390 flood plain acres were evaluated using this method.

ECONOMICS

Non-agricultural

Damage to non-agricultural property, although significant to the watershed as a whole, was not sufficiently concentrated in specific areas so as to be a major consideration in formulating structural measures for flood prevention. Damage evaluated was primarily to roads and bridges. Fragmented flood reports by watershed residents and county road officials were relied upon in estimating flood damages.

Specific attention was focused on gathering information on small floods of a size which could be expected to occur yearly as well as on a large flood of a size approximating a 10-year event. Available data were transferred to similar road and bridge damage points on which little or no historical information was available.

Evaluation was performed using the storm damage information obtained together with flood routings as a basis for constructing simple damage-frequency curves. Those damages appearing insignificant (less than \$50 average annually) and those not appreciably affected by the project were screened from the evaluation process.

Indirect

Indirect damages were evaluated as a percentage of direct flood damages. Percentages utilized were 5 percent of crop and pasture damage and 20 percent of non-agricultural damage.

Joint flood prevention and drainage benefits

Flood prevention benefits of the more intensive use type were evaluated jointly with drainage benefits on the following acreages:

Reach A - 2,107 ac.	Reach E - 2,368 ac-
Reach B - 4,521 ac.	Reach F - 876 ac.
Reach C - 1,709 ac.	Reach J - 504 ac.
Reach D - 4,715 ac.	TOTAL 16,800

Method of evaluation was the "net income" procedure as described in Chapter 3 of the Economic Guide. Benefits were determined on a composite acre basis for the typical water problem area as described under "Watershed Problems." Acres of benefit indicated above represent but 81 percent of the total problem area evaluated. This percentage compares to the combined percentages of water problem subareas 1, 2, and 3 discussed previously.

Extent of benefited area was determined by a sampling process. In total, 50 percent of the watershed area was sampled. Only those areas conforming to the typical water problem area were considered for benefit delineation of this type. Sample results indicated a spread in percentage of area benefited ranging from 42 to 58 percent. Average

ECONOMICS

Joint flood prevention and drainage benefits - cont'd

of all samples was 53 percent benefited area. Results from the sampling process were expanded to other watershed area. A key to the overall evaluation was an assessment of expected crop yield increases which would result from the project under future conditions. Information supplied through farmer interview, judgment of agronomic and soils specialists familiar with the area, and projected yield data developed by the Economic Research Service for the Ohio River Basin provided the basis for these determinations.

Land use projections were based largely on judgment. Local interviews set the framework for the projections. A summary of pertinent land use and yield data is shown below. Present condition information is recorded for general interest. It is significant to the evaluation only in reflecting the base point from which the projection of future condition land use and yields were made.

<u>Present Condition</u>			<u>Future Conditions</u>					
			<u>Without Project</u>			<u>With Project</u>		
Crop	Yield	Land Use %	Yield	Land Use %		Yield	Land Use %	
Corn	120 bu	33.7	150 bu	52.5		176 bu	52.5	
Soybeans	37 bu	16.3	51 bu	26.2		63 bu	26.2	
Wheat	42 bu	5.5	59 bu	4.3		68 bu	4.3	
Hay	3.5 t	21.8	4.5 t	4.3		5.2 t	4.3	
Pasture	125 aud	4.4	75 aud	4.4		75 aud	4.4	
Other	--	8.3	--	8.3		--	8.3	
TOTAL		100.0		100.0			100.0	

Gross income increase with project was then computed using current normalized prices. Deduction of increased cash production costs and associated costs for the installation of on-farm improvements supplied a measure of increased net income. This composite acre value is recorded below.

	(All Reaches)
Increased Gross Income	32.20
Increased Production Costs	1.35
Associated Costs	<u>10.11</u>
Increased Net Income	20.74

Figures presented above reflect full development values prior to the application of discounts for lag in accrual and lack of participation. A weighted average discount value of 0.813 was determined based on 50

ECONOMICS

Joint flood prevention and drainage benefits - cont'd

percent of the area receiving full benefit from the onset of the project, another 40 percent requiring a gradual buildup to full benefit over a 10-year period, and the remaining 10 percent not participating.

Total primary benefits were determined by applying the composite acre net income increases to the benefited areas delineated by the sampling process, then discounting for lag in accrual. Results are shown:

	<u>(Reaches A-F)</u>	<u>(Reach J)</u>
Net Income	20.74	20.74
Benefited Area (acres)	16,300	504
Discount Factor	0.813	0.813
Subtotal	274,844	8,499

Benefits derived were assigned 50 percent to the flood prevention purpose and 50 percent to drainage.

Secondary benefits

Secondary benefits were evaluated based on benefit values and using the income multiplier.

Prices and interest rates

Current normalized prices as transmitted by the Water Resources Council in February 1974, served as the applicable price base for computation of project benefits and operation, maintenance and replacement costs. Estimated construction costs for project installation were based on 1974 prices.

Annual equivalent of installation costs and project benefits were computed using a 5 7/8 percent interest rate. Private expenditures connected with the installation of on-farm improvements required for the realization of project benefits were converted to annual equivalents using an 8 percent interest rate.

Cost allocation

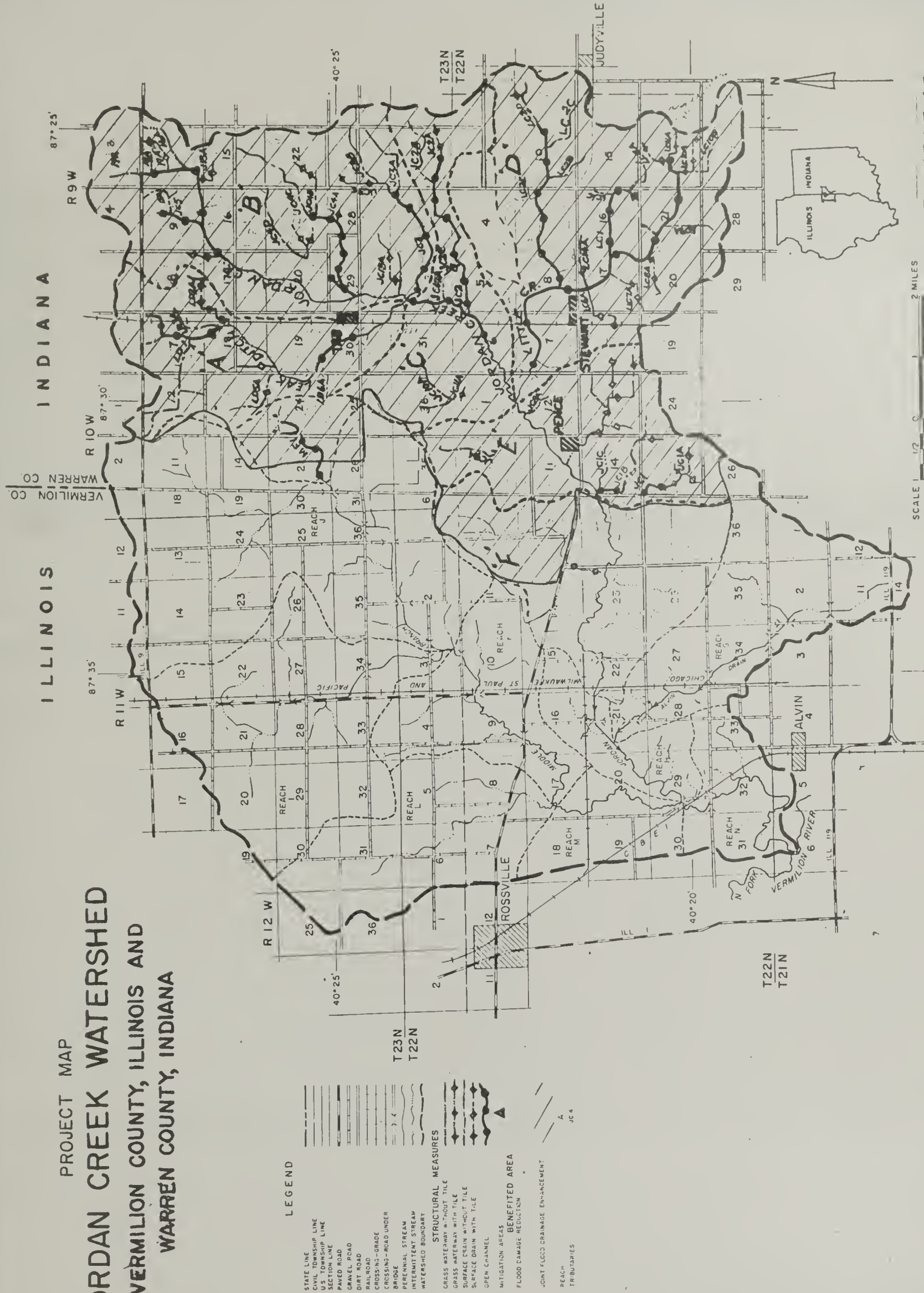
All structural improvements other than tile were considered multiple purpose drainage and flood prevention features. Tile were considered single purpose drainage installations. Joint costs on multiple purpose improvements were allocated under the first alternative as described in Chapter 3 in the Watershed Protection Handbook.

EXHIBITS *

<u>Exhibit No.</u>	<u>Description</u>
1..	DEFINITION OF CONSERVATION PRACTICES AND LAND USE
2	ILLUSTRATIONS OF CONSERVATION PRACTICES
3	ILLUSTRATION OF ONE-SIDED CHANNEL WORK
4	TYPICAL CHANNEL CROSS-SECTION
5	TYPICAL DEFLECTOR
6	CHANNEL PROFILES
7A.	ESTIMATED SOIL LIMITATIONS OR SUITABILITY FOR SELECTED USES
7B.	KEY TO EXHIBITS 7A AND 7C
7C.	GENERAL SOIL MAP
7D.	DESCRIPTION OF SOIL ASSOCIATIONS ON THE GENERAL SOIL MAP
8	SURFICIAL GEOLOGY MAP
9	POTENTIAL BIRDS, MAMMALS, AND FLORA
10	SURFACE WATER QUALITY ANALYSES
11	GROUND WATER QUALITY ANALYSES
12	PROJECT MAP

* Note: Above listed exhibits are in for reproduction. They will be involved in the draft EIS that will be submitted for inter agency review.

PROJECT MAP
JORDAN CREEK WATERSHED
VERMILION COUNTY, ILLINOIS AND
WARREN COUNTY, INDIANA



UNIVERSITY OF ILLINOIS-URBANA



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